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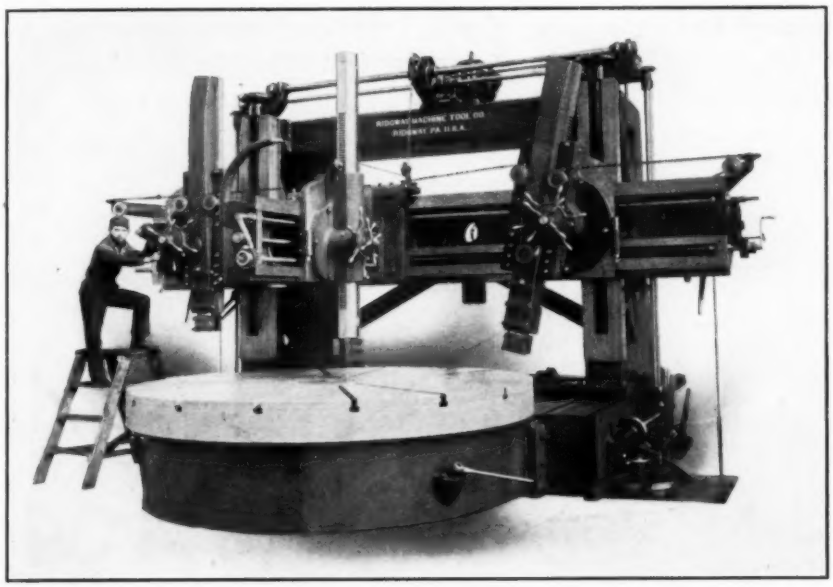
Index to Advertisers and Classified Index Following Reading Matter.



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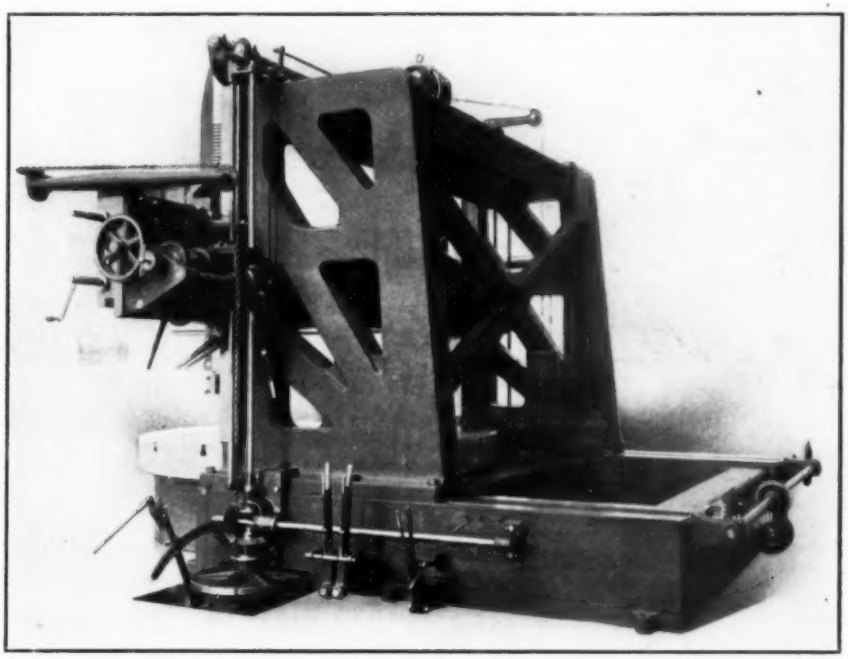

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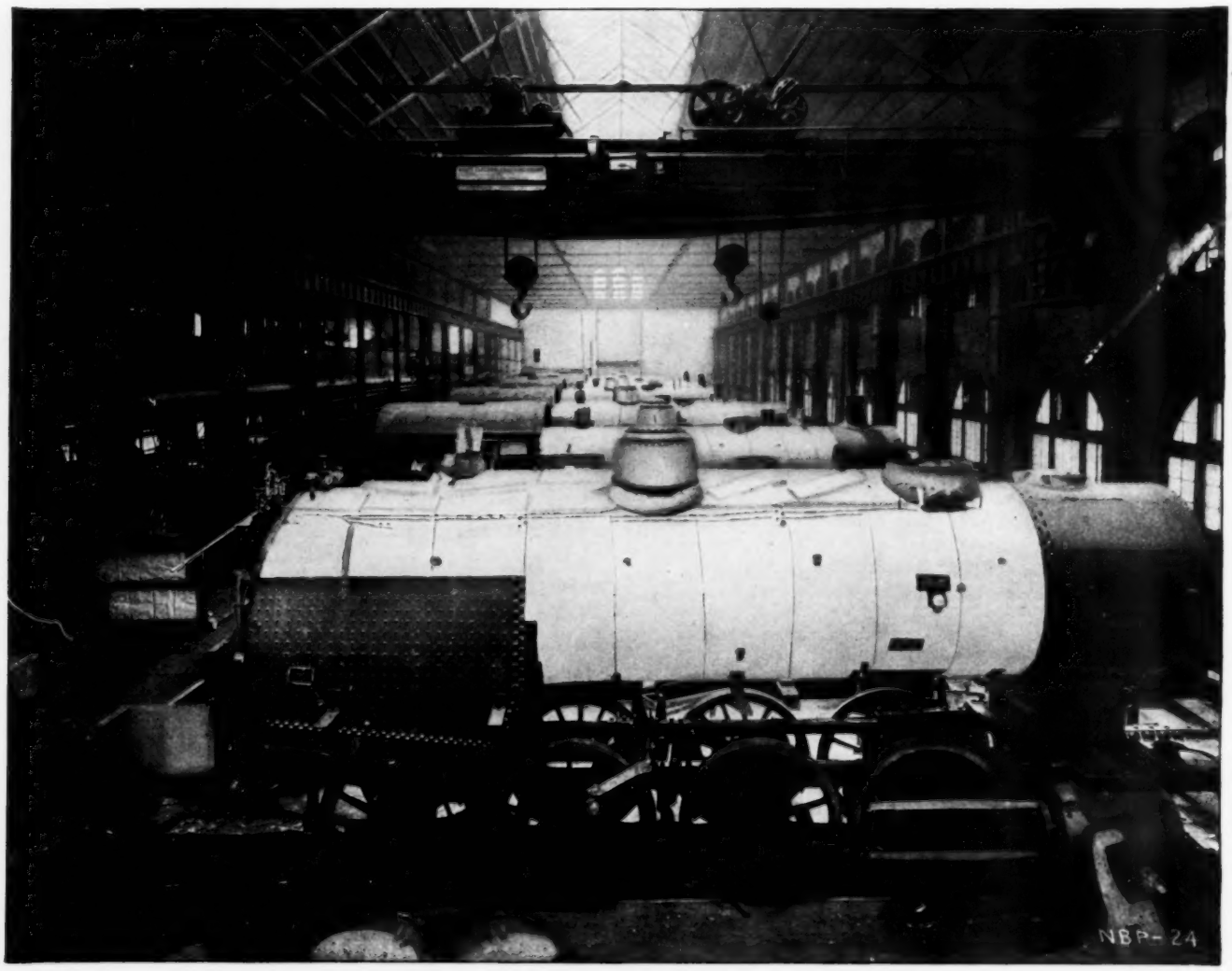

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A Large Cold Flanging Machine.

BY E. A. SUVERKROP.

Few machinists have, I suppose, ever heard of glass-lined steel tanks. I must confess that I was ignorant of their existence till I went to Rochester, N. Y., to get some data regarding the machine mentioned in the caption.

On my arrival I was met by the inventor of this large flanging machine, Mr. D. O. Paige, general manager of the Pfaudler Company. Together with Mr. W. G. Markham, secretary and treasurer of the Pfaudler Company, we went out to the factory situated on the western outskirts of Rochester. The shop, one story high, 600 feet long by 320 feet wide, is devoted exclusively to the manufacture of glass-lined steel tanks. These tanks are used for many purposes, the principal of which are brewing and distilling, they superseding the unsightly and unsanitary wooden tanks in common use. Nearly all the machines and methods used are patented. Mr. Paige is the originator of the majority of these devices and processes. On going thru the shop I discovered that while unique in its own field the flanging machine was only "a part of the show." So in order to give Mr. Paige the credit due him for developing the various appliances used and the reader an insight into the very interesting manufacture of glass-lined tanks, it is better for me to follow the plates thru their stages of evolution into tanks.

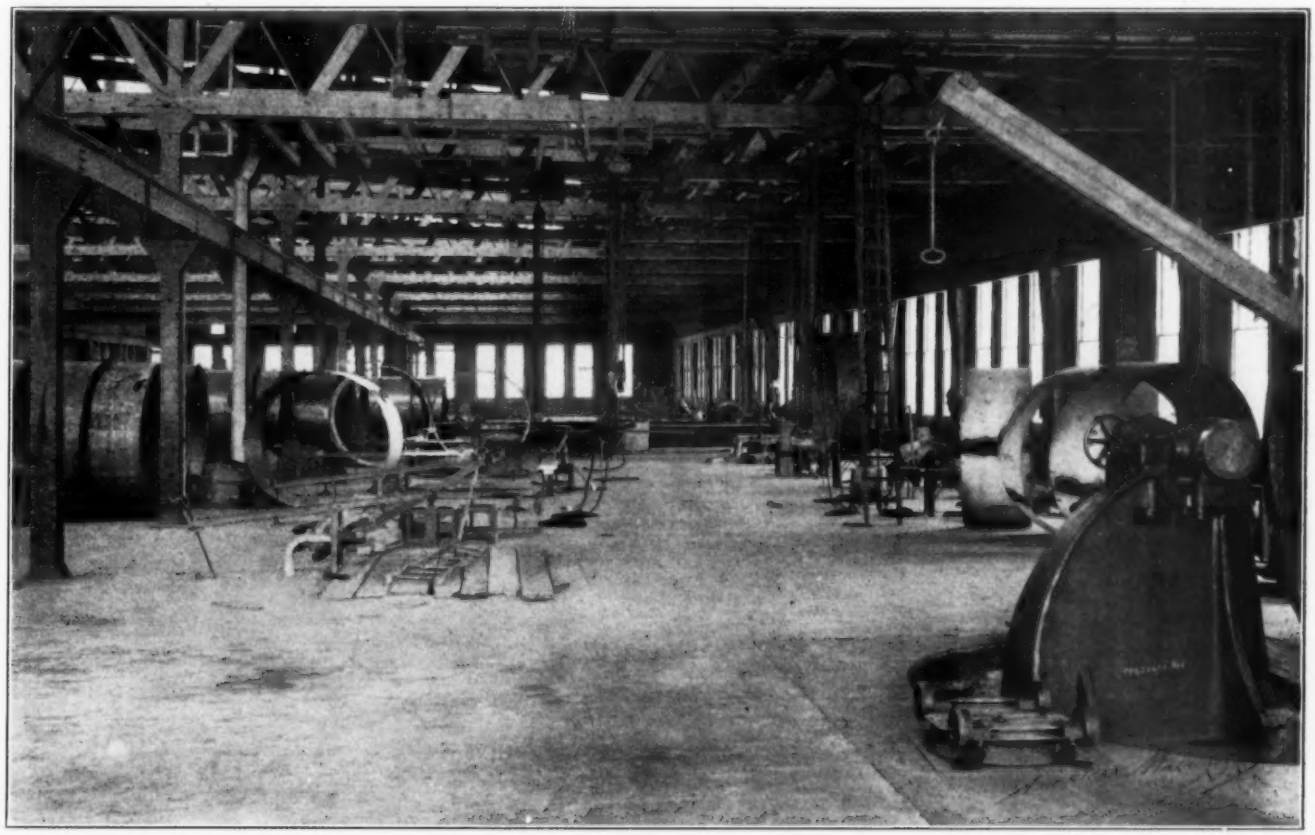


FIG. 1. WHERE THE PLATES ARE TRIMMED, ROLLED AND WELDED.

THE MANUFACTURE OF GLASS-LINED TANKS.*

The weight of plates used in the construction of these tanks averages at present about 18 tons daily. They are brought in on cars, there being a siding which runs into the building at the rear of Fig. 1. About the center of Fig. 1, away back near the railroad track, is a large shear. This shear is provided with suitable tables so that plates which are not straight may have their edges trimmed. It is necessary that both the edges should be parallel and the ends properly squared.

SCARFING THE PLATE ENDS.

From the shear the plates go to the scarfing machines. There are two of these, one for each end of the plate. They are a species of milling machine and each carries two angular cutters of high-speed steel. The spindles are so disposed that one cutter is at the center of the plate and one at the side of the plate when the machine is started. The cutters are fed down to working depth and the feed thrown in. By the time the cutter that was in the center of the plate has reached the side, the cutter that was at the side has reached the center and the one end of the plate is thus scarfed after the cutters have traversed but one-half of its width. Mr. Paige has other machines in contemplation in which he expects to use four or more cutters and thus further reduce the time in scarfing. During the scarfing operation the plates rest on several hinged bearers which are fastened to the top of a long carriage. It is obvious that the plates must be scarfed as at Fig. 2, *i. e.*, on opposite sides. The scarfing machines do not scarf both ends simultaneously, two machines being used so as to avoid turning the plates round end for end. It is not, however, convenient to mill both ends at the same time. One set of cutters would be milling underneath and owing to the various lengths of the plates for the different sized shells—they vary from 3 to 10 feet diameter by 30 to 48 inches deep—one of the machines would have to be portable, which would be troublesome.

The hinged bearers, Fig. 3, on the long carriage before referred to are used to turn the sheet over on to a second long carriage which is in line with the milling machine which scarfs the opposite end of the plate.

ROLLING, RIVETING AND WELDING.

After being scarfed the plate is rolled to a circle and the scarfed joint is riveted together so as to hold it while being welded. The forges used for welding the shells are of special construction. So far it is only possible to weld a few inches at a

*The manufacture and introduction of steel glass-lined tanks, for the various uses to which they are applied was developed by Messrs. C. C. Puffer, president of the Pfaudler Co., E. G. Miner, vice president, W. G. Markham and D. O. Paige, assisted in the past two years by A. I. Jones, superintendent.

heat. At Fig. 1 may be seen part of the welding appliances situated over the pits which are shown covered with boards. The riveted shells are lowered into these pits, the forges—using coke as fuel—are then placed in position under the scarfed joint and the blast started. Immediately over the opposite side of the part of the joint to which the heat is being applied a piece of firebrick—mounted on the end of an iron rod—is held to retain the heat. After being heated on the inside and hammered on the outside, the shell is suspended and the heat again applied, this time on the outside, while the hammering is on the inside.

Mr. Paige has placed an order for a helve hammer having a long reach. He is also experimenting along the lines of oil fuel in the hope of ultimately being able to heat the shells all the way across and welding at one heat. To the right at Fig. 1 may be seen three shells, the black band being the weld.

FLANGING THE SHELLS.

After welding, the shells go to the flanging machine. The idea of making a machine on these lines occurred to Mr. Paige some fifteen years ago. After consulting with several engineers only to be told that such a machine would never work, he decided to build one anyway. He took his drawings to a prominent machine-tool builder in the East, who, after looking the drawings over, refused to take the job, saying that he could not afford to build a machine which he was sure would be a failure. Eventually Mr. Paige found two young men who had just started in business in Newark and were as yet untrammeled with a reputation to lose. They tackled the job and built the first machine with a maximum capacity of 6 feet. The machine was finished and shipped to Detroit, where the Pfaudler Company had their works at that time. The machine worked, and worked all right the first time, and has been running ever since. In all these years but one ring has been spoiled, and that thru the carelessness of the operator in tightening the flanging roller too much and thus cutting the flange off. The same flanging roller is on the machine to-day that was put there fifteen years ago. This first machine has a solid spindle. The second flanging machine, illustrated in Figs. 4 and 5 and the line cuts 6 and 7, is a hollow spindle machine with a capacity of 48 inches thru the spindle. At present there is no use for a hollow spindle of these dimensions. It was, however, incorporated in the design by Mr. Paige with a view to possible future development. To quote his own words, "Some fellow will come along some day and devise a way of producing welded or solid drawn steel pipe of large diameter and then we will have to flange his work for him."

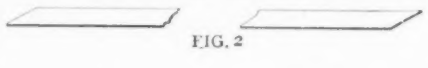


FIG. 2

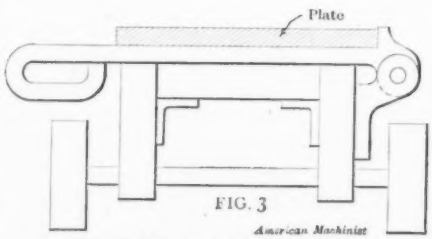


FIG. 3

THE PLATE AND THE CARRIAGE.

Fig. 4 is a view of the machine with a flange nearly completed. In this view most of the driving mechanism for the spindle is in plain view. The only part which cannot be seen is the pinion and the internal gear with which it engages at the back of the face-plate. The motor which drives the machine develops 30 horsepower. The gear ratio between the face-plate and the motor is 200 to 1.

Fig. 5 shows the other side of the machine. In this view the chuck jaws are open, the shell having been removed from the machine. Upon this side of the machine the chuck-actuating mechanism is plainly visible. The reversible 12 horsepower motor seen at the top is for opening and closing the chuck jaws. The pinion shown in engagement with the large spur toothed ring is thrown into or out of mesh by an eccentric. Upon the side of the large spur toothed ring bevel teeth are cut which engage with the bevel pinions on the ends of the chuck-jaw screws to the nuts of which are fastened the large segmental angle plates forming the chuck jaws. The jaws are eight in number—a set for each size of shell. When closed upon a shell the edges of the jaws come nearly together. It will be noted by referring to Fig. 5 that the edges of the jaws are tongued and grooved; when closed the tongues engage the grooves and thus the jaws support each other. The swinging

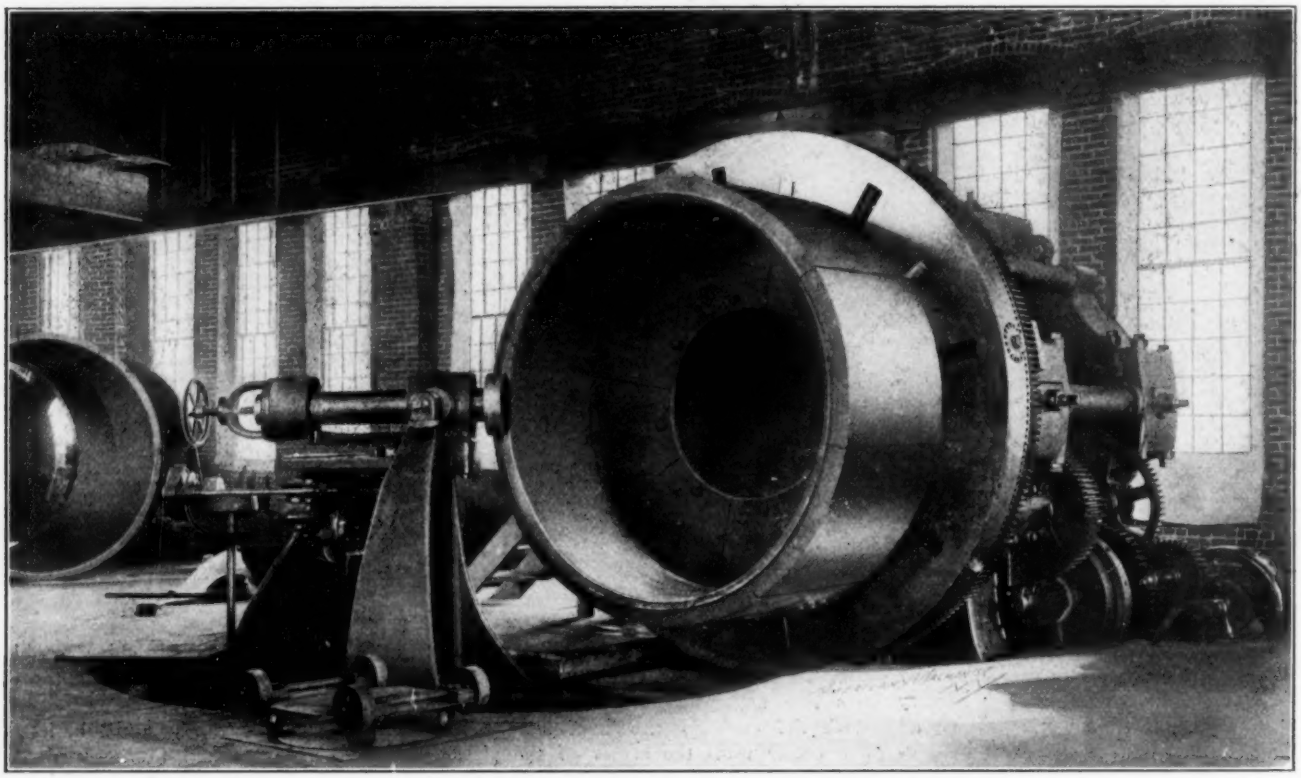


FIG. 4. THE FLANGING MACHINE, SHOWING MOTOR DRIVE.

bracket which carries the flanging roll, seen in Figs. 4 and 5, rests upon a semi-circular table which in turn is mounted upon two slides at right angles to each other, the object of this construction being to permit the machine to handle a variety of sizes of shells ranging from 3 to 10 feet inside diameter. This bracket while operating on a flange makes a quarter turn on its axis; the lower part of the bracket is supported upon conical rolls, the semi-circular table before referred to having an angular face to accommodate these rolls. The longitudinal adjustment of the flanging roll is by means of a screw and hand wheel shown in Figs. 4 and 5. Just below the rear bearing of the casting which carries the flanging roll spindle is a fulcrum which permits a certain amount of swinging movement to this casting. The final adjustment of the flanging roll against the inside of the shell—where the flanging is always started, the flanging naturally being from the inside toward the outside so as to stretch the metal of the flange, the outside diameter of which is about 4 inches greater than that of the shell—is by means of a screw abutting upon the front bearing and adjusted by the square box wrench shown lying on the top of the web connecting the two members of the bracket in Figs. 4 and 5.

The bracket which carries the flanging roll is a steel casting, as is also the main spindle of the machine. The spindle, together with its chuck, weighs 72,000 pounds. The main frame of the machine is of gray iron, the total weight of the machine being some 130 tons.

By referring to Figs. 6 and 7 the general arrangement of the flanging machine may readily be grasped. It will be seen that the spindle rests upon the three steel rollers X at the bottom and has two similar rollers at the sides and one on top. The same arrangement applies to both ends of the spindle. The rollers at the top and sides are adjusted by means of screws while wedges are used for those on the bottom, see Fig. 7. At J in Fig. 6 is shown the general arrangement of the chuck. This chuck, by the way, is as far as known the largest universal chuck in existence. It was built by the R. D. Nuttall Company, Pittsburg. The workmanship of this chuck was entirely satisfactory to Mr. Paige.

At Fig. 7 the other view of the rollers X is shown. The conical rollers Y are for taking the thrust of the spindle. The arrangement of the supporting bracket for the flanging roll is also shown at Fig. 7. The conical rollers Z support the heavy cast-steel housing, making it easier to move than were there a sliding contact. It will be noted that in Fig. 7 the rotary movement of the flanging roll support is arranged to be by hand, and in Fig. 6 the machine was to be driven by belt; both these are worked by motor, as shown in Figs. 4 and 5. The arrangement of the special chuck jaws is also shown at Fig. 7 in the upper left-hand corner. There is a device for centering the rear end of the shell and supporting it while the front end is being flanged. The device consists of a series of eight clamps fastened to the face-plate and projecting outward thru an opening between the jaws of the chuck. These clamps have a rectangular slot turned in them of such dimensions that the end of the shell may be inserted. When the shell is back against the bottom of the clamps they are tightened so as to hold the back edge of the shell.

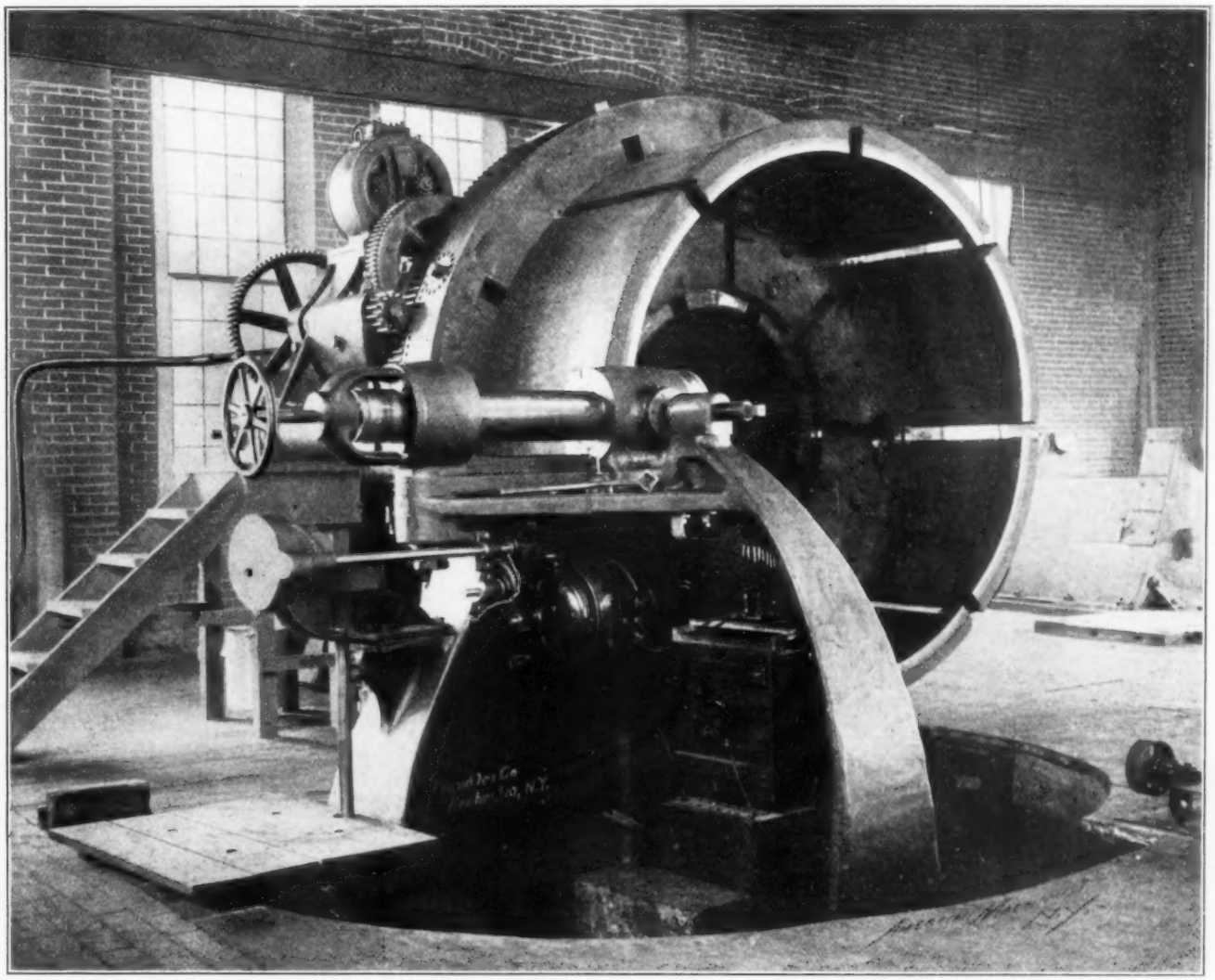


FIG. 5. FLANGING MACHINE, SHOWING CHUCK OPENING AND CLOSING MECHANISM.

The old form of clamp used may be seen inside the shell at Fig. 4. In this style a screw clamp was used. The present way of tightening is by an eccentric clamp instead of a screw. The handle of this clamp, about 18 inches long, is provided with a spring friction which bears upon the flat part of the chuck jaws and prevents the eccentric clamp loosening its hold. The time taken to put in, flange and take out a 10-foot shell is about 20 minutes, but the machine with two operators is expected to turn out only twenty-four flanged 10-foot shells a day of ten hours. The small turntable, which looks like an overturned truck, shown in front of the flanging machine in Figs. 1 and 4, is for handling the shells reversing, and turning them around. The flanging machine was built by the Chambersburg Engineering Company, Chambersburg, Pa., and is an exceptionally fine piece of work.

PUNCHING THE BOLT HOLES IN THE FLANGES.

After both ends have been flanged the bolt holes are punched in the flanges. This job is done on a heavy Long & Allstatter punching machine. The punch and die holders are arranged to take ten punches and dies set in an arc, each diameter of shell having a set of punches and dies. A large index ring is fitted inside the shell and centered. Fitted to the stripper is an indexing point which engages with the notches on the index ring. Two stands secured to the floor hold the index ring and its attached shell, centering them sideways while the index point steadies the job and spaces it correctly. One man and a helper can punch about twenty 10-foot shells a day—and these shells are interchangeable. It is very necessary that they should be interchangeable, as the tanks are shipped all over the world. The day I was at the works a shipment was on the cars marked "Delagoa Bay." In going that distance it is quite possible that one of the "rings" making part of a tank might be injured, in which case a duplicate ring can be sent from the factory with the assurance that it will fit when it reaches its destination. Or, should it be desirable to increase the capacity of a tank, one or more rings may be added at any time without sending the tank to the factory or making templets.

PREPARING THE STEEL FOR THE RECEPTION OF THE GLASS.

From the punch the shells go to the sand blast, where all scale is removed, leaving them perfectly clean with a slightly rough surface for the reception of the glass. The shell after being carefully dusted off is wet on the inside with water and put into a large dustproof room, the wooden doors of which may be seen in the brick wall to the left in Fig. 8. In this room the glass is applied to the wet surface. The glass is in the form of an impalpable powder. It is put into cotton bags and shaken over the wet surface much the same as foundry facing is applied to a mold. After the dust has settled the doors of the room are opened and the ring is carefully taken out, the truck upon which it rests is run over to the front of the furnace, the door of which is at the extreme left of Fig. 8.

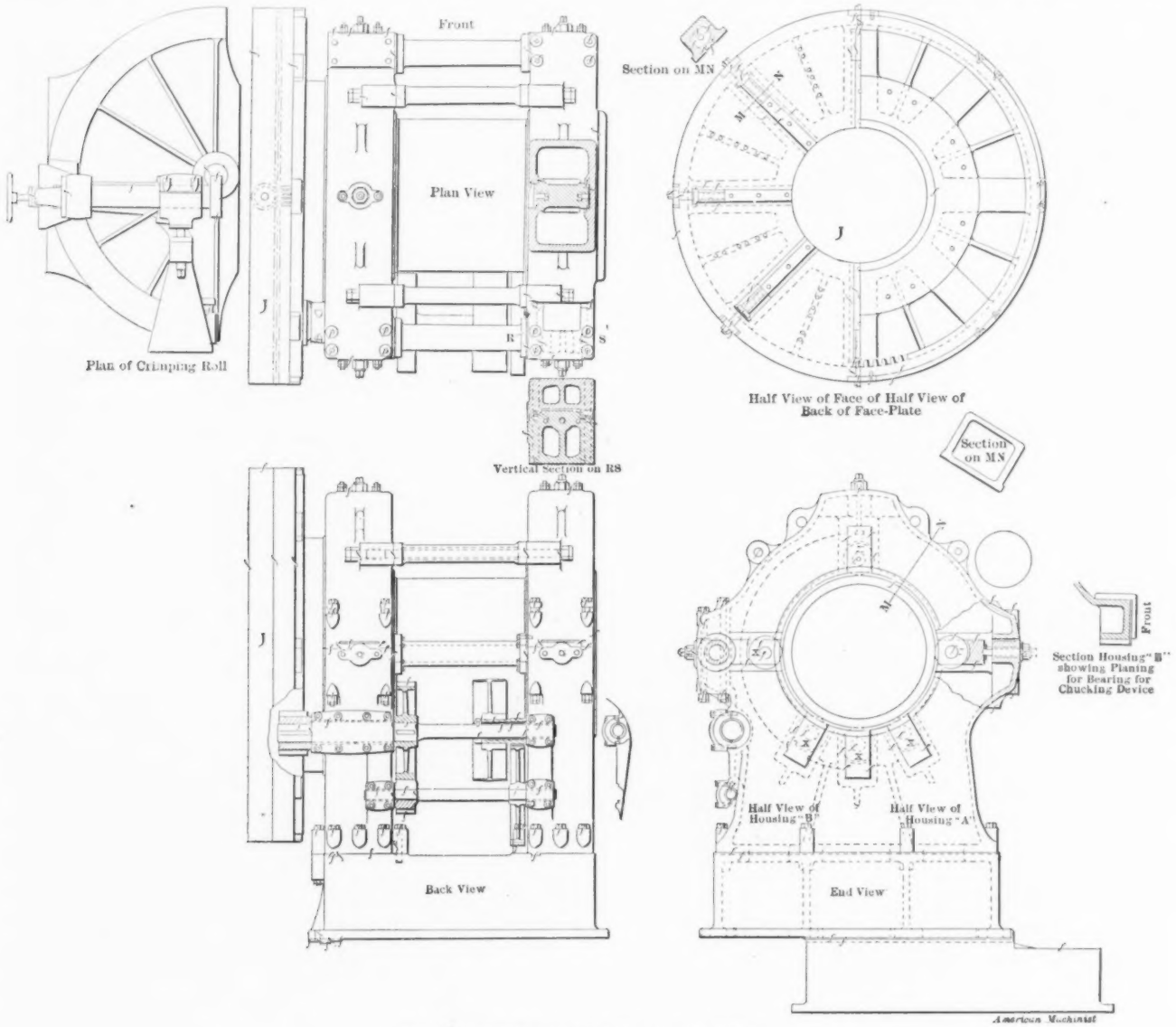


FIG. 6. DETAILS OF FLANGING MACHINE.

In line with the furnace door but above it will be seen two tracks which carry a traveling pneumatic hoist. At the left or outer end of this hoist may be seen a species of four-jaw chuck which picks up the ring and places it in the furnace, depositing it upon a turntable. This turntable is actuated by hand and permits the ring to be heated evenly. In the center of the door of the furnace, above the little iron stool, may be seen a small, round peep hole with a cover. This cover may be swung to one side and the work inspected while being heated.

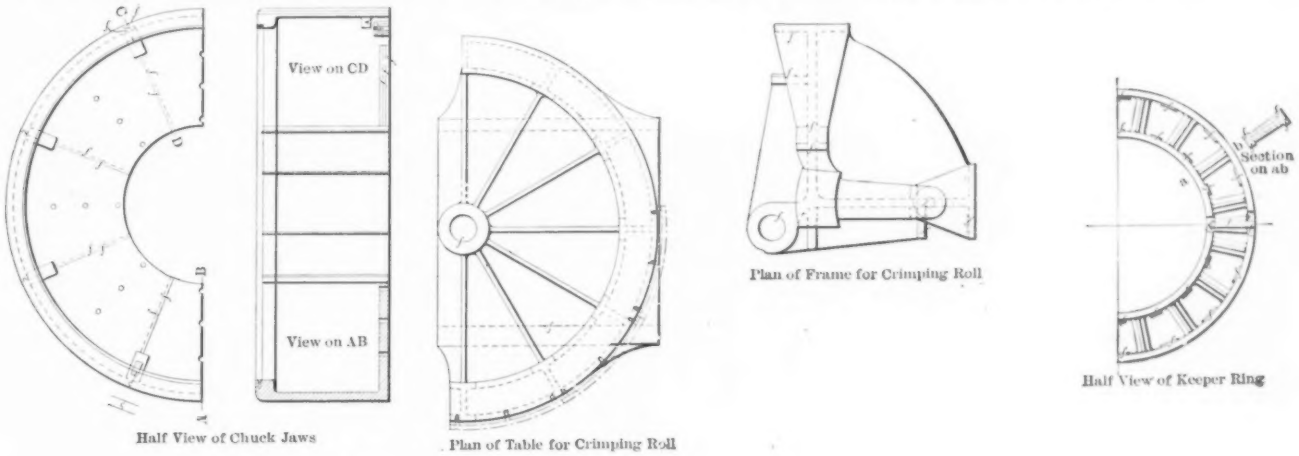
The enamel or glass usually used for coating steel melts at about 800 degrees, but the glass used by the Pfaudler Company fluxes at about 2,000 degrees. It takes about ten minutes to "glass line" a 10-foot ring. The ring is then taken out and allowed to cool. The man's position on the traveling hoist is never less than about 16 feet from the furnace, and in this position he operates the chuck opening and closing mechanism very readily. Fig. 9 shows the traveling air hoist and chuck. Fig. 10 shows an enameled ring. When the powdered glass is first applied it is pure white, but after firing it is mottled with gray and green and has a very pretty surface. The heat necessary to flux the glass on the inside causes the outside to scale, so after the shell or head is cool it is again sand-blasted on the outside to remove this scale and leave a surface for painting.

MAKING THE HEADS.

The heads are hot pressed to shape in the large hydraulic presses shown at Fig. 11. The output of this press is about sixty-five 10-foot heads a day. A track leads from the reverberatory furnace, where the plates are heated, to the press. Owing to the number of heads handled in a day by the press, the dies gave trouble by cracking, owing no doubt to unequal expansion. The dies are of gray iron—the shape of the heads they make is seen in dotted lines held in the crane chuck at Fig. 9. Formerly the dies were made solid, but now two slots are cast in the dies, about ¾ inch wide at right angles to each other right across the dies and extending from the back of the die to within a short distance of the face, allowing the iron to expand without cracking.

BUILDING THE TANKS.

Fig. 12 shows a gang of men building up a tank. The gaskets are made of some sort of woven material with a U-shaped covering of block tin about 1-32 inch thick, the round part of the "U" going to the inside and thus the tin part of the joint only comes in contact with the beer or spirits when the tank is in use.


View on CD
View on AB
Half View of Chuck Jaws
Plan of Table for Crimping Roll
Plan of Frame for Crimping Roll
Section on ab
Half View of Keeper Ring

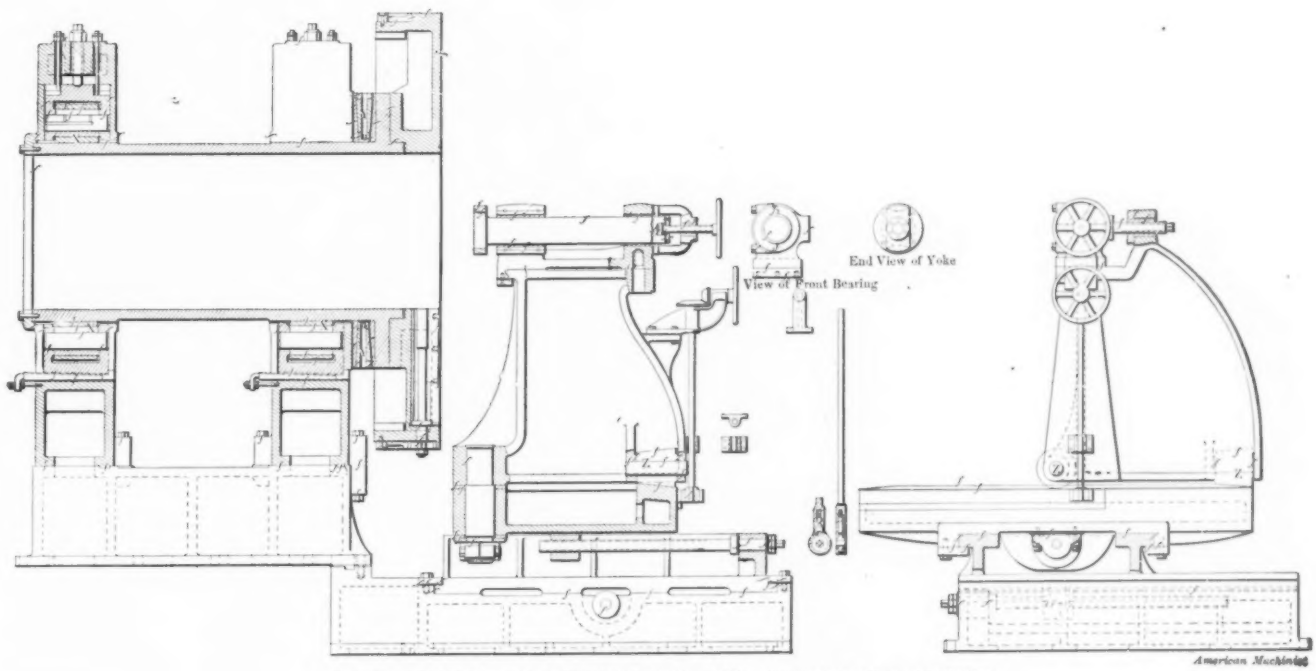


FIG. 7. DETAILS OF FLANGING MACHINE AND FLANGING ROLL BRACKET.

THE STOCK.

Fig. 13 shows a small part of the stockroom. When I was at the works there was about $300,000 worth of finished tanks on hand. Mr. Paige mentioned that one of the orders on hand would take more tanks than they have in stock to fill it.

A NOVEL MANHOLE DOOR SUPPORT.

At Fig. 14 is shown a very clever attachment for a manhole door, swinging it out

of the way and supporting it ready for the reception of the gasket. The dog is merely turned part way around after the nut is slackened part way off the stud and the door swung in to the tank. Anyone who has been compelled to handle a hot manhole door without assistance will appreciate this simple and effective device.

THE PLANT.

The power plant at the Pfaudler works consists of a 250 horse-power Westinghouse engine direct connected to a 200-kilowatt generator, a Snow hydraulic generator for operating the large hydraulic presses, and three air compressors, two for the sand blast at 16 pounds and one for the hoists at 80 pounds. Water is obtained for the plant from three artesian wells. All thru the works are to be seen

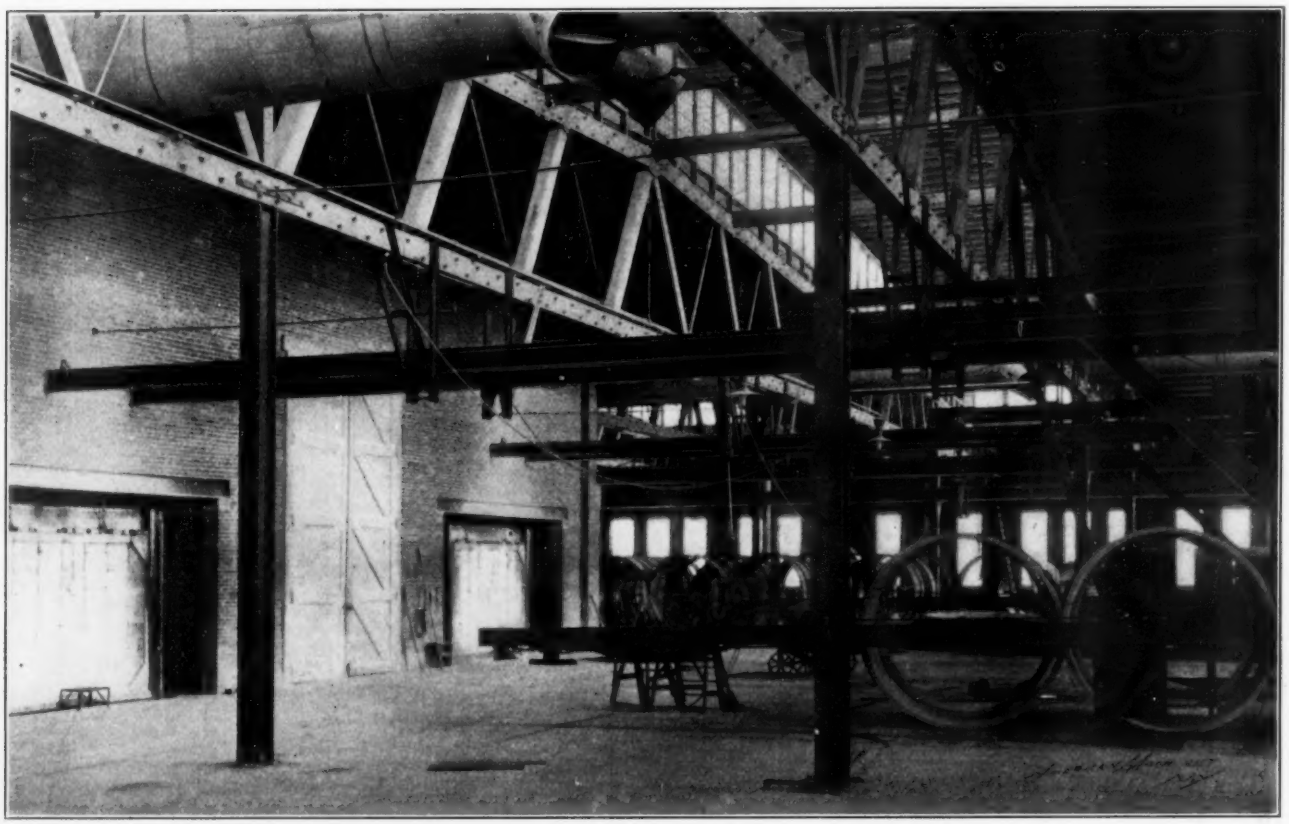


FIG. 8. GLAZING FURNACE AND TRAVELING PNEUMATIC HOIST FOR THE SHELLS.

appliances for expediting the work. For fear of drawing this article out too much I have omitted mentioning many of these. But I, like Koko, have them on my list, and some day soon the readers of the AMERICAN MACHINIST will get them.

An internal combustion motor was shown in operation at Cambridge, England, in 1820. The inventor, Rev. W. Cecil, Fellow of Magdalen College, in a paper describing his invention suggested that "ardent spirit," turpentine or vapor of oil might possibly be used instead of the gas which he employed.

Why chop down a tree to chop it up again?

For Completeness of System.

BY HENRY G. SCHWOEPPE.

We are advised to judge the tree by its fruits. When a machine is bought we take it subject to trial, or on the say so of someone who has tried it. We buy machinery not to demonstrate our wealth nor from purely philanthropic motives, yet some manufacturers will assure you with tears in their eyes that they need the money; and, judging them by myself, I guess that's right. We buy it because we need it, or at least think we do in our business, and in that case some missionary agent has cultivated the belief. When a machine pans out all right it is kept and is run as long as possible, or until we are convinced that it will improve or increase our product to supersede it with one of a later and generally better type. An instrument only lately placed on the market determines the speed of your work, and another, already some time in use, shows the amount of power consumed and the percentage used to effect the actual operation. These are supplemented by other ingenious devices, patented and otherwise, the use of which demonstrates clearly the accuracy and efficiency of the particular tool or machine to which they may be applied.

Not only the manufacturers, but the consumers as well, are benefitted by these inventions and appliances, produced for the measurement of possibilities, financially expressed. Yet how many manufacturers to-day are aware that this constitutes but a portion of the necessary equipment? Some time ago I was seated in the office of a large manufacturing concern. The president was looking over his mail and suddenly turning to me he said, handing me two screws, "Schwoeppe, you ought to know about what these screws should cost. Here's a fellow has made me a price, but he wants about 75 to 80 per cent. profit." After reasoning a little bit I told him what I thought they could be made for in the average shop. "Well," said he, "that's about the price he quoted; but I believe I can make them much cheaper myself." Now, while he has a modern shop, many conveniences and some very fine automatic and semi-automatic machinery; while he has numbers of jigs and fixtures well above the average, I don't believe he could produce the articles at anything near the price he figured. Why? Because he has no way of ascertaining what these things cost. Beyond a guess he hasn't the slightest idea of an hourly or daily burden. He figures that running a cost system is a luxury, and that it furnishes nothing more than data which he has done so well without for so many years.

In other words, while he wants and gets the best machinery on the market, he does not know whether the machines are so handled as to give such results as are claimed for them by the makers. While he does not wear overalls, he goes out into the shop considerably and he knows (?)

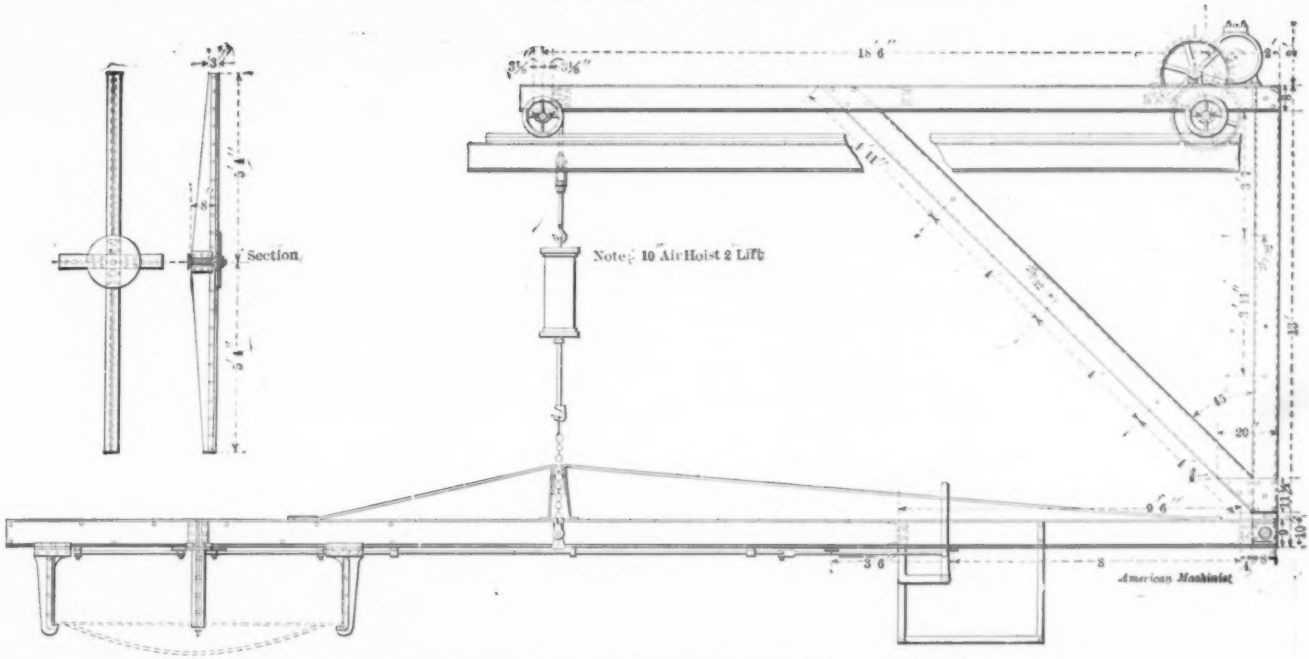


FIG. 9. TRAVELING CRANE FOR HANDLING WORK IN THE FURNACE.

everything is running at its fullest capacity. Some shops are equipped with the most truthful devices for obtaining speeds, feeds and output, but unless this is recorded by impartial methods little or no results can be possible. Machines have their constants, we can fairly rely on data furnished us from experiments; but how about the men behind the guns? It is a conceded fact that the finest tools in poor hands are at best poor instruments. While we try to buy a machine at its lowest market price, is first cost the only consideration? Not much. We have a certain class or kind of work to do and we select the lowest priced machine that will perform the operations satisfactorily; we weigh pros and cons conscientiously and we rely on impartial, proven devices to test their efficiency.

HOW THE MEN ARE HIRED.

But the operator? Well, we find out his past history from some disinterested party, take some things—that is, most of them—for granted, and instruct a subordinate to hire him at his lowest price, the assumption being that a small loss in

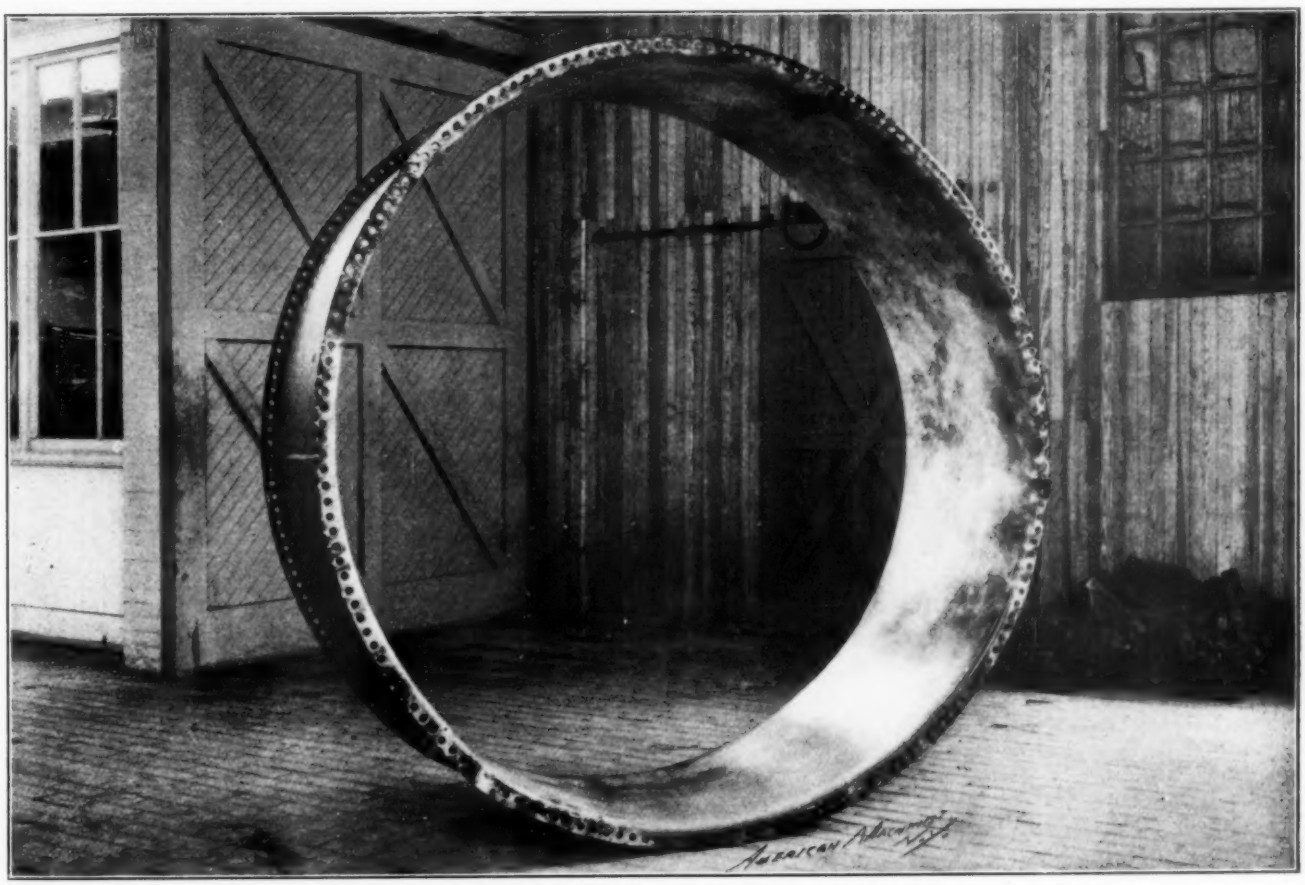


FIG. 10. TEN-FOOT RING AFTER BEING COATED WITH GLASS.

wages is easier to bear than a large one. Would it not be a fine thing to know the extent of such loss if it really exists, and whether it might not be remedied? Suppose we hire a man, and at a low price, but that, compared with what he ought to do, he is working at a loss, not only for the firm, but also to himself. Who is to blame? He? Possibly not. As long as his employer is satisfied, why should he worry? He gets his "raise" when he kicks, provided he is on good terms with the foreman. He has absolutely no incentive to arouse his ambition. He produces about so much a day, speeds up a little in the presence of the boss, and when the coast is clear drops down again to make the job last. His knowledge of the foreman's sins and shortcomings puts him out of the danger zone, as far as that official is concerned, and he is thereby also enabled to charge up some hours to odd jobs. Unless there are corresponding inducements, *why* should he work any harder, and thus gain the ill-will of fellow-employees and possibly be termed a "sucker," or some other equally pungent tho no less undesirable title?

Such an employer pats himself on the back that he is free from labor troubles, and that the ever-vigilant foremen he employs are just like so many faithful dogs, guiding his flock in peace and tranquility; only he perhaps finds some day that, owing to another reduction of prices made by a competitor, he had better relinquish his fatherly authority to someone better qualified, in obedience to the natural law that determines the survival of the fittest. A man in busines has no right to be negligent, in justice to himself and to those dependent upon him. He should know the cost of production, and avail himself of all legitimate means to lower the same. Each development thru which material passes tends to increase its cost.

THE SHOP BURDEN.

In the average present-day manufactory or shop we consider the material in the shape of castings, bars, shafts and plates as rough material. We add to it not only the cost of handling and machining, but also a percentage for expenses, made up of salaries, interests and discounts, boxing and crating and all non-productive labor incident to the carrying on of such an establishment. There are different methods of computing this shop burden, but the principle remains. The best method of arriving at the cost of labor is to find out exactly what each of the various operations costs. It may then be possible to reduce the cost of any certain one by the use of a jig or a special cutter, by changing the shape of the casting to be machined or otherwise, so as to require less time. It will show also which machine and which operative are best adapted to such work. The only objection to this procedure, which is the fairest way of establishing the comparative worth of men and machines, is its cost of maintenance and the increased burden resulting therefrom, in which case the evil may seem to be preferable to the cure.

AUTOMATIC SYSTEM.

But the system can be, and is, simplified to work almost automatically. Looking at an automatic machine which to-day is one of the most important factors in reducing the cost of production, it does appear intricate, elaborate and costly, and its cost of installation is worthy of some consideration. But the cost confines itself mostly to first cost, and that's the inducement for installing. It is true that if each manufacturing plant were to build up these machines for themselves, employ the designers, draftsmen and engineers who have made such machines the study of their lives, do all the experimenting requiring a considerable amount of time and money, the project would be an unprofitable venture, for our great industrial institutions were not built that way.

Why should any plant to-day be able to establish a profitable cost system any more readily than it can build special machinery? In the design of a machine the experiments of a lifetime have often been fruitless; yet you will find concerns trying to discipline shops on the same principle on which they would be building special machinery, which latter they acknowledge would be an unwarranted expenditure. As simple as are the various forms, sometimes two and three for the same identical purpose, as practical and concise as they have often been presented to the readers of the AMERICAN MACHINIST, these little cards that save trouble and labor are still looked upon as elaborate details of an intricate cost system which only the very rich can afford. A system that, like an automatic machine, *can* be built at the home shop, can still be bought more cheaply ready made than worked up piecemeal, because it requires more patience and study than the average shop management can, or is willing to, give.

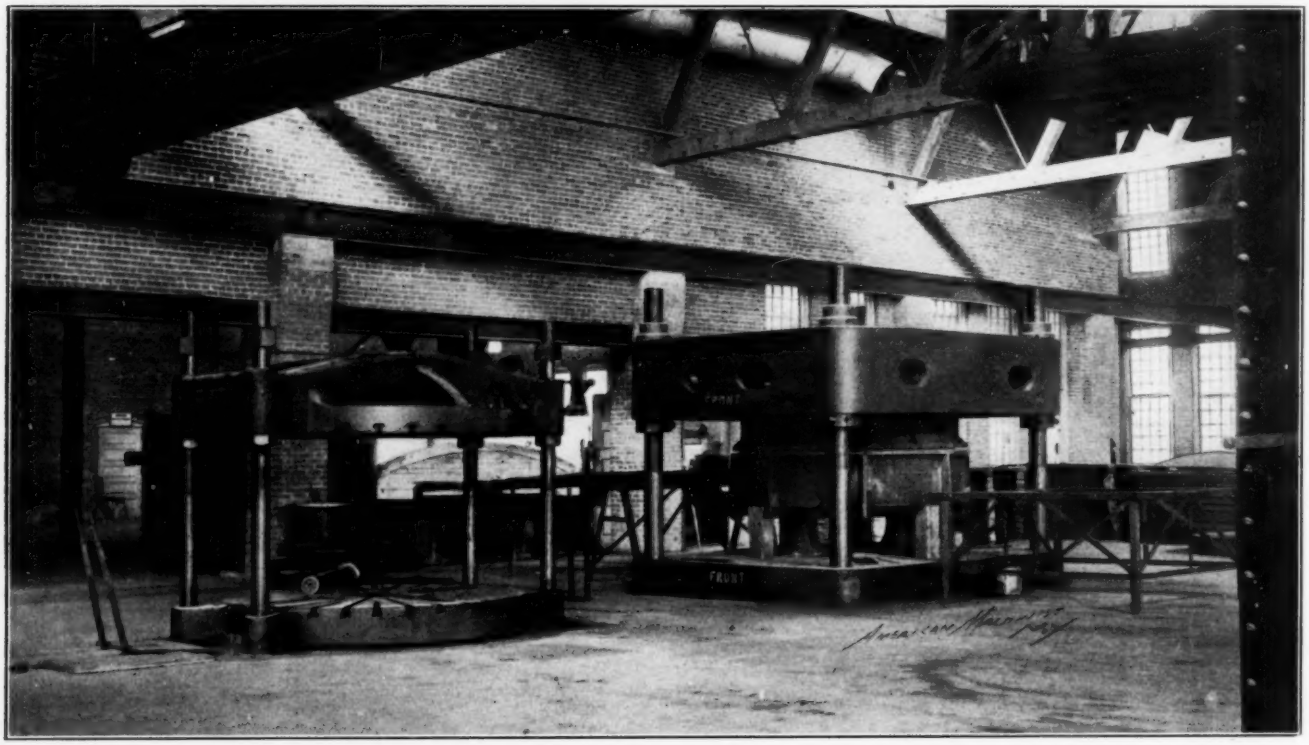


FIG. II. THE LARGE HYDRAULIC PRESSES FOR FORMING THE HEADS.

Conditions will sometimes make it impossible to transplant bodily the same forms from one place to another, but the fundamental principle is the same. Unless properly adjusted it will act like a pair of badly fitted eye-glasses. To be effective it must supply or take the place of the instrument that as yet has not been invented.

THE HOMO-METER.

Lathes, drills, planers and milling machines may be supplied with c' t-meters, feed boxes, patent quick-feed change gears; they may have the finest oiling and lubricating devices obtainable; this all is but half the battle. While much depends on the machine, more depends on the man, and still more on the executive who has charge of that man. Appreciation of any accomplishment supplies the biggest incentive to strive for more laurels, and the result is best shown financially. There is no other way of giving and receiving orders that will fasten responsibility as securely as in writing, nothing to beat written orders, and these can only be furnished and intelligently acted on when

FIG. 12. BUILDING UP THE TANKS.

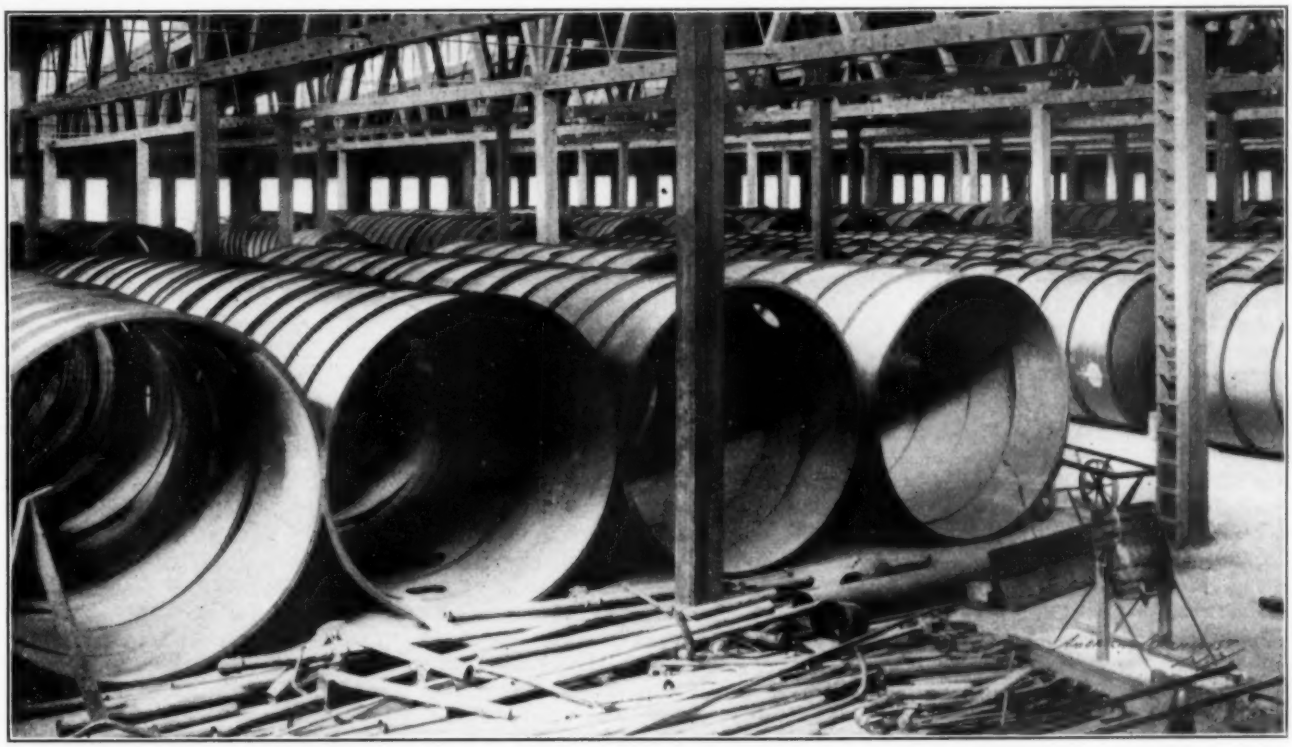


FIG. 13. PART OF THE STOCK ROOM, WHICH IS 300 BY 320 FEET.

used in a scientific manner, coupled with a liberal use of genuine common sense.

This is system. No workman, honest or otherwise, will object to an intelligent record of cost-keeping, as this is as much to his interest as it is to the interests of the employer. It is gratifying to him (on pay day) to know that his efforts are acknowledged by the man to whom they mean dollars, and he is well affected morally and financially. Noticed or unnoticed, some men will force recognition; they are bound to succeed in spite of all obstacles. They are of the kind in whose hearts hope springs eternal, who believe they will be on top, because you can't keep a good man down. Many of our present-day manufacturers are of that stamp. Their success is measured by thousands upon thousands of dollars, and in their individual cases the homo-meter was not necessary, but it would not have been objectionable either. The average man needs encouragement. If men were judged as to their fruits, how much different it would be. If a good man was recognized, he would be more encouraged. Success, recognized by others in superior capacity, would kindle enthusiasm that would be productive of much good result. It is folly to trust thousands of dollars' worth of energy to foremen alone. It is unjust that responsibilities which the owners are unwilling to carry should be placed on the shoulders of men whose exceptional abilities have brought them positions as foremen. They cannot develop better means or improved methods, when asked to store away mental records, that the firm pays heavily for in the shape of wages, yet refuses to record because of its being too expensive, ignoring the fact that death may rob them of years of experience, deprive them of a valuable asset at possibly a critical moment. Some systems may be no more than red tape—pronounced failures. It is, however, wrong to condemn a class because some few have failed to graduate. Of the successful ones we hear little, but powerful industrial institutions bear witness to the systematic use of good common sense. There are still people who figure the horse-power of steam engines without considering the steam gage. I could not do it.

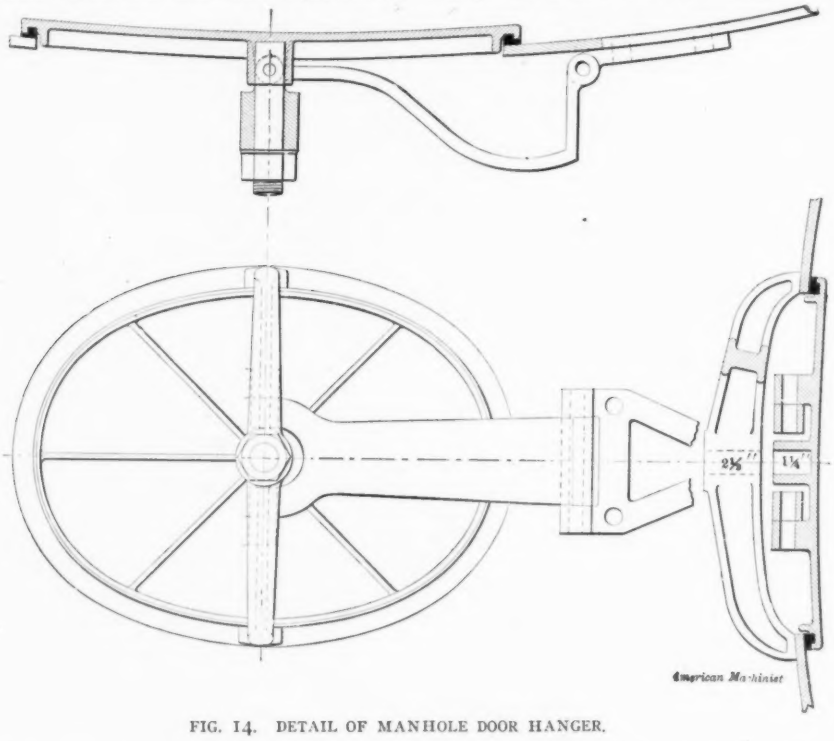


FIG. 14. DETAIL OF MANHOLE DOOR HANGER.

German Tool Trade Conditions.

The members of the Association of German Machine Tool Builders reported concerning the last quarter of 1904 in the majority of instances "satisfactory," "good," "continuing good," or even "very good." In some cases it was remarked that inquiries were coming in well, but the receipt of orders left something to be desired, and that trade was not in all respects as good as in the preceding quarter. Compared with the last quarter of 1903, the period showed a decided improvement, only a small part of the reports stating that the volume of business was no better. In several cases depressed or inadequate prices, due to sharp competition, were complained of. Labor conditions were regular, with neither a lack nor unusual supply of help, only, as ever, the difficulty of securing skilled workmen was occasionally felt. Wages were generally unchanged, tho in some places they showed a rising tendency. Shortening of hours was not resorted to, but in some cases the execution of urgent orders caused overtime work. There were hardly any strikes. One South German factory complained of the higher price of coal. The best builders have been doing most business.

Power Press Details.

BY EDWARD F. CHANDLER.

THE RATCHET PRESS FEED.

If we are going to design an entirely new feed mechanism, we require to be informed of the stroke of the press and the length of feed per stroke, besides the proportions and relations of the parts of the feed mechanism. Should the press be provided with a feed gear, and such information as: what ratchet will give a certain feed? or *vice versa,* is required, the circumference of the feed rolls only is needed. For a feed gear of the type shown in Fig. 1 the circumference is used in the following formula:

$$\frac{\text{cir. of feed rolls}}{\text{required feed}} = \text{teeth of ratchet.} \quad (a)$$

$$\frac{\text{cir. of feed rolls}}{\text{teeth of ratchet}} = \text{required feed.} \quad (b)$$

In construction work we make use of this formula:

$$\text{Req. feed} \times \text{teeth of ratchet} = \text{cir. of feed rolls.} \quad (c)$$

The feed must start after the punch is stripped and stop before the punch reenters the stock. We may save some trouble by laying out a diagram like Fig. 2, which shows the position of the plunger and feed crank during one cycle. Beginning at *A* the punches pierce the stock, enter the die, strip and re-enter the stripper, the plunger stopping at the highest point *A* upon completion of the stroke. The length of the arc to be used for feeding is *a A b*, as the punches are then within the stripper and free from the stock. This shaded portion, which represents the active travel of the feed crank, is to be shifted around on the diagram so as to feed while the press crank moves thru *a A b*. The adjustment for the number of teeth used on the ratchet is obtained by sliding the connecting rod in the slot, Fig. 1.

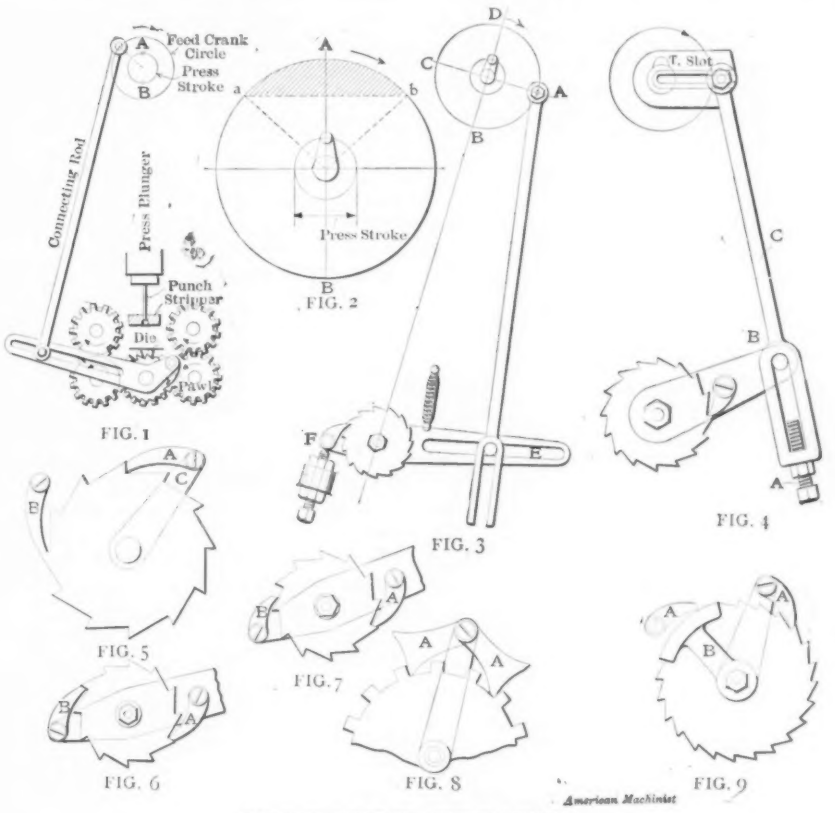
In Fig. 3 we have a feed gear of somewhat different construction and better adapted to fine work. In this case the adjustment for the number of teeth is accomplished by adjusting the screw *F* under the pawl head and moving the stud in slot *E*. As the feed crank turns from *A* to *B* the fork pushes the stud down, thus driving the ratchet in the direction of the arrow. From *B* to *D* the fork rises and the lever is drawn back by the spring. The feed crank is set 90 degrees ahead of the press crank.

Fig. 4 shows a substantial form for heavy work. The tendency to run over is overcome by the application of a brake placed at some convenient place, generally upon the rolls and often against the face of one of the feed gears at the end of the press. This arrangement, which is quite simple, may be used to advantage in the perforating of heavy sheet metal. Adjustment for the number of ratchet teeth taken depends upon the adjustment of

screw *A* and the positon of the stud in the T-slot of the feed crank. The slotted rod pushes the stud *B* down, and as the rod rises the screw point strikes the stud and brings it back to its first position.

In the above attachments the motion of the ratchet is transmitted to the rolls by a gear or a train of gears, according to the direction in which the rolls are to turn and to the specific circumstances.

The illustrations, needless to say, are merely diagrams and are not necessarily in proportions that could be recommended for practical use. In Fig. 3 the construction of the adjustable stud is to be carefully considered, as the constant jamming of the fork is a serious factor of this otherwise simple design. In Fig. 4 considerable attention should be paid to



RATCHET FEEDS FOR POWER PRESSES.

the leverages, as the heavy sheets and the brake will offer high resistance. It is generally well to use large driven gears upon the rolls and a small driver upon the ratchet shaft, which should help materially to reduce the starting strain.

THE RATCHET PAWL.

The pawl is by no means to be overlooked on account of its littleness. The general simplicity of the pawl permits us to dwell more upon its application and uses than upon its construction. Fig. 5 shows a ratchet wheel turning about a center pin. *C* is a vibrating lever carrying the pawl *A*. As the arm moves to the right the pawl lifts and slides over the points of the teeth; when it returns the pawl drops against the face of a tooth and carries the wheel with it. The idle pawl *B* is so placed as to fall behind each tooth as it passes under, preventing a reverse rotation.

In the case of a large number of fine teeth upon the wheel, constant usage sometimes strips the faces and makes the feed uncertain. Now, considering it improbable that exactly opposite teeth will be spoiled, the arrangement shown at Fig. 6 may be employed. The pawls are of the same length and work together, so that if the ratchet is in good condition only half the strain is taken by each pawl and tooth, and when a tooth is missed by one pawl the other is pretty sure of holding, thus making this extra pawl a safeguard.

Supposing that we have a ratchet with a certain number of teeth and it is desirable to use spaces obtainable by using half teeth or a ratchet of twice as many teeth. Now rather than secure another wheel we may change one pawl, substituting in place of it a short one which will fall behind by one-half the pitch, as in Fig. 7. These two pawls work alternately, each pushing the wheel ahead one half of a tooth at a time. Similarly we might divide the space into thirds by using three pawls.

In feed mechanisms where it is desirable to run the wheel in either direction, as upon shapers and planers, an arrangement like Fig. 8 is used. The ratchet has radial teeth, and the pawl, which is symmetrical, may occupy either position, *A* or A^1.

Fig. 9 shows a convenient method for adjusting the number of teeth per stroke. The pawl *A* is made wide enough to run upon the shield *B*, which is movable about the center. Noting that the stroke is from A^1 to *A* in the direction of the arrow, it may be seen that there are only four teeth exposed, which of course will be the number used, and when *A* runs back to the position A^1 it again stops upon the shield. By making this shield longer it may serve to stop the feed entirely.

A Scientific Historical Society.

An international company or association for purposes relating to the history of natural sciences, technology, industry, trade, etc., is being promoted, with good prospect of success, by F. M. Feldhaus, of Heidelberg. The objects are to maintain an office for the collection and preservation of literary material; to publish a monthly journal to be called *Internationales Archiv fuer Geschichte der Technik und der Naturwissenschaften*, and other works, such as a dictionary of invention; to hold annual conventions; to secure the establishment of historical chairs of instruction, and in various other ways to further the interests of the history of science. Herr Feldhaus has already interested over 350 special historians, resident in twenty countries, and names a number of them, among whom are the brothers Director L. Beck and Prof. Th. Beck, authors respectively of important historical works relating to iron and machine construction. Of the required 500,000 marks capital he had some time ago secured the promise of 210,000 marks.

One of the objects of the new society is to act as a wise counselor regarding the erection of memorials to inventors and the like. "I recall to mind," says Herr Feldhaus, "the doubtful propriety of existing memorials, such as that to Bertholdus, named 'Schwarz' in Freiburg, as inventor (?) of gun-powder; to Koster in Haarlem, as inventor (?) of book printing; to Drake in Offenburg, as introducer (?) of the potato; to Madersberger in Kuffstein, as inventor of the first serviceable (?) sewing machine; to the inventor (?) of the telephone, Innocenzo Manzetti, in Aosta; also the dispute about the propriety of a Flavio Gioja memorial, at Amalfi, as inventor (?) of the mariners' compass."—*Condensed from the Zeitschrift des Oesterr. Ingenieur und Architekten-Vereines.*

The barometer falls about one-tenth inch for each 90 feet of ascent above sea level for the first 1,000 feet, but the rate of fall continues to decrease, and at an altitude of 5,000 feet it falls one-tenth inch for 160 feet in increased elevation. The boiling point of water is often employed to determine elevation above or below sea level. At 500 feet below sea level the boiling point is 213 Fahr.; at sea level, 212 Fahr.; at 5,270 feet it is 201.9 Fahr.; at 10,011 feet it is 193.2 Fahr.

Studies in Inventive Problems—V.

Proposed by Leicester Allen and Solved by Various Readers.

The interest taken in these studies is very gratifying. Naturally solutions by American readers arrive first, and as they are numbered in order of their reception, those from foreign countries must appear later, but are no less welcome. So far, criticism has not been profuse. I expect quite an avalanche of it when my own solution appears.

SOLUTION NO. 18, FIG. 1, "CALAMUS."

This correspondent, who desires his real name suppressed, sends a very neat sketch of a character different from any other received. It requires quite a number of parts to effect the movement.

"The lines *A B* and *B C* form the proposed path. *M* is a table free to move on ways *L L'* and carrying an auxiliary table *N*, which moves on guides *D* parallel to *B C*. The table *M* is connected with crank *P* by the connecting rod *O*. The table *N* moves the sliding block, being attached to the center at *X*, and it is connected with crank *E* by the connecting rod *K*. *W* is a continuously rotating shaft connected with shaft *T* carrying crank *P* by a train of intermittent gears *S R*, described later. Shaft *F* carries crank *E* connected with driving shaft *W* by the pair of miter gears *U*, the splined shaft *I* and intermittent gears *H* and *G*. The two trains of intermittent gears, for the sake of convenience, are drawn alike in the detail. *S*, as also *G* in the plan, is a gear having teeth on the arc 6-8-7 and a blank arc 7-6, concaved as shown in detail, this arc being as small as construction will permit. This gear is so placed on shaft *T* that the radius bisecting the angle 7-5-6 and the radius from center of shaft *T* to center of crank pin *P* shall lie in a plane common to both radii. *R*, as also *H*, is a gear having a sufficient number of teeth on the semi-circumference 3-2-1 to engage with all the teeth of the arc 6-8-7 on *S* or on *G*. A semi-rotation of the shaft *W* causes the table *M* to travel forward and backward on the ways *L L'*, thus making the geometrical center *X* to traverse the line *A B* as demanded. During the other half-rotation of *W* the carriage *M* will stand still; but, by means of a corresponding arrangement of the gears *G H*, the slide *N* can then be made to move forward and backward on its ways, carrying the point *X* along the line *B C*, since the slide *M* carries the slide *N* and all its mechanism. Both slides may move simultaneously if desired; in which case the line traced by the point *X* might be a diagonal of the rectangle formed on *A B* and *B C*, or any of several regular curves with beginnings at *B*. Therefore when *X* reaches *B*, should there be any tendency to lost motion, either on account of the cranks being on a dead center or on account of the "dead" arc of the block 7-6, the same can be eliminated by adjusting the gears. That is, let the motion of the train which is to take up the work from *B* begin rotation before the other has come to rest, and let it advance to such a point that, on the instant when *X* reaches *B*, the forward motion on either the horizontal or vertical line, as the case might be, would begin. The arrangement, as described, provides that the time of travel over the line *B C* would be as long as over the line *A B*, which is twice the length of *B C;* but this was merely to simplify the description. Many different ratios of speed could be substituted by merely introducing suitably proportioned gears. The advantages of a solution of this kind are the power that could be transmitted to the slide, and, secondly, the opportunity which it presents of easily varying the ratio of the speed of travel over one line of the path as compared with that of the other."

SOLUTION NO. 19, FIG. 2. C. W. PITMAN, PHILADELPHIA, PA.

I have doubts whether this movement could be made to engage and disengage the sliding block at the angle of the path with such exactness as to preclude a slight pause at that point of the path. Otherwise it will perform all the requirements of the problem. The studs *b* and *c* would need to be stout, and the racks *B* and *C* would in actual construction need to be stiff and well supported if the block *A* is subjected to much resistance.

"The wheel *W* rotating as shown by the arrow drives, thru the clutch, the gear *D* and therefore rack *B* which, by its engagement with stud *b* on the slide *A*, compels movement of the latter. The sketch shows the slide approaching the angle, and stud *c* just entering the hole in rack *C* at the corner and gear *D* passing out of mesh with rack *B;* the latter remains stationary, and the auxiliary tooth on gear *E* (*E* being fast on the same shaft with *D*) striking the pin *h* on rack *C*, throws gear and rack into mesh, and slide *A* begins its vertical travel. When it reaches the top, cam *e* and bell-crank lever *f* trip the clutch and the motion of gears *D* and *E* is reversed thru the bevel gear arrangement, and sliding block *A* is returned to the corner, stud *b* entering the hole in rack *B* during its descent. Here the extended tooth on *D* strikes pin *g*, *D* and *B* are thrown into mesh and the sliding block is carried outward to its limit, when the clutch is again tripped, the motion reversed, and the circuit completed."

Mr. Pitman sends a second solution which is identical with solution No. 15, except that for the cam disk *H*, of Mr. Cowles, he uses a second cam cylinder.

SOLUTION NO. 20, FIG. 3. JOHN F. CAVANAGH, PROVIDENCE, R. I.

"Lines *A c* and *B c* are the lines along which the center of the block *D* is to travel. *E* is a slider traveling in guides parallel to *B c*, and has a recess which fits a portion of block *D*, as shown. *E* is made to travel over the distance *B c* by means of the rotating arm *F'* and connector *K*. By means of a similar arrangement *E'* is made to travel over the path designated by *A c*. G^1, G^2 and G^3 are intermittent gears arranged as shown. The arms *F* and *F'* are rigidly fastened to G^2 and G^1, respectively. If power be applied to G^3 the tooth portion, which is shown in mesh with G^1, will cause the arm *F'* to swing to a position directly opposite, thus bringing block *D* to position *C* and into the recess in *E'*. The moment the tooth portion on G^3 leaves G^1 it will start acting on G^2, causing arm *F* to make a complete revolution, thus sliding block *D* to position *A* and back to *C*. In this manner block *D* is kept moving over the stipulated path. It would be necessary, of course, to have the guides for *E'* in a position over that of the guides for *E*."

Other rejected solutions are the following:

S. J. Monahan, Oshkosh, Wis. Cams and Springs.—The motion at the terminals of the path being limited only by the tension of the springs, exact movement to the terminals without exceeding the limit would be impossible on account of the momentum of the moving parts, especially with rapid motion.

A. Bienfaid, Cleveland, Ohio.—This solution is imperfect because it has a dead point when the center of the sliding block coincides with the angle of the path.

F. G., Stockbridge, Mass.—Fragmentary hints at possible solutions, but nothing carried out.

Amos J. Knight, Philadelphia, Pa. Rock levers with forked ends engaging a pin in the sliding block, operating on the bell-crank principle and deriving their motion from a cam. The centers of the rock shafts bearing the rock levers are so situated that when the center of the block coincides with the angle of the path the pin will not pass out of the forked end of either rock lever and into the forked end of the other, unless so much lost motion is permitted as to prevent the center of the block from describing the sharp right angle required by the statement of the problem.

Geo. W. Cole, South Bend, Ind.—The corner of the sliding block, or of the ways, is required to be rounded off to avoid binding from the tilting of the block, neither of which alternatives is in accord with the terms of the problem.

H. E. Shephard, Providence, R. I.—Want of clearness in the sketch renders this unavailable for publication. Possibly the description would make the device clear, if the sketch were less diagrammatic.

Karl Kromer, Elgin, Ill.—The sliding block will tilt in turning the angle of the path.

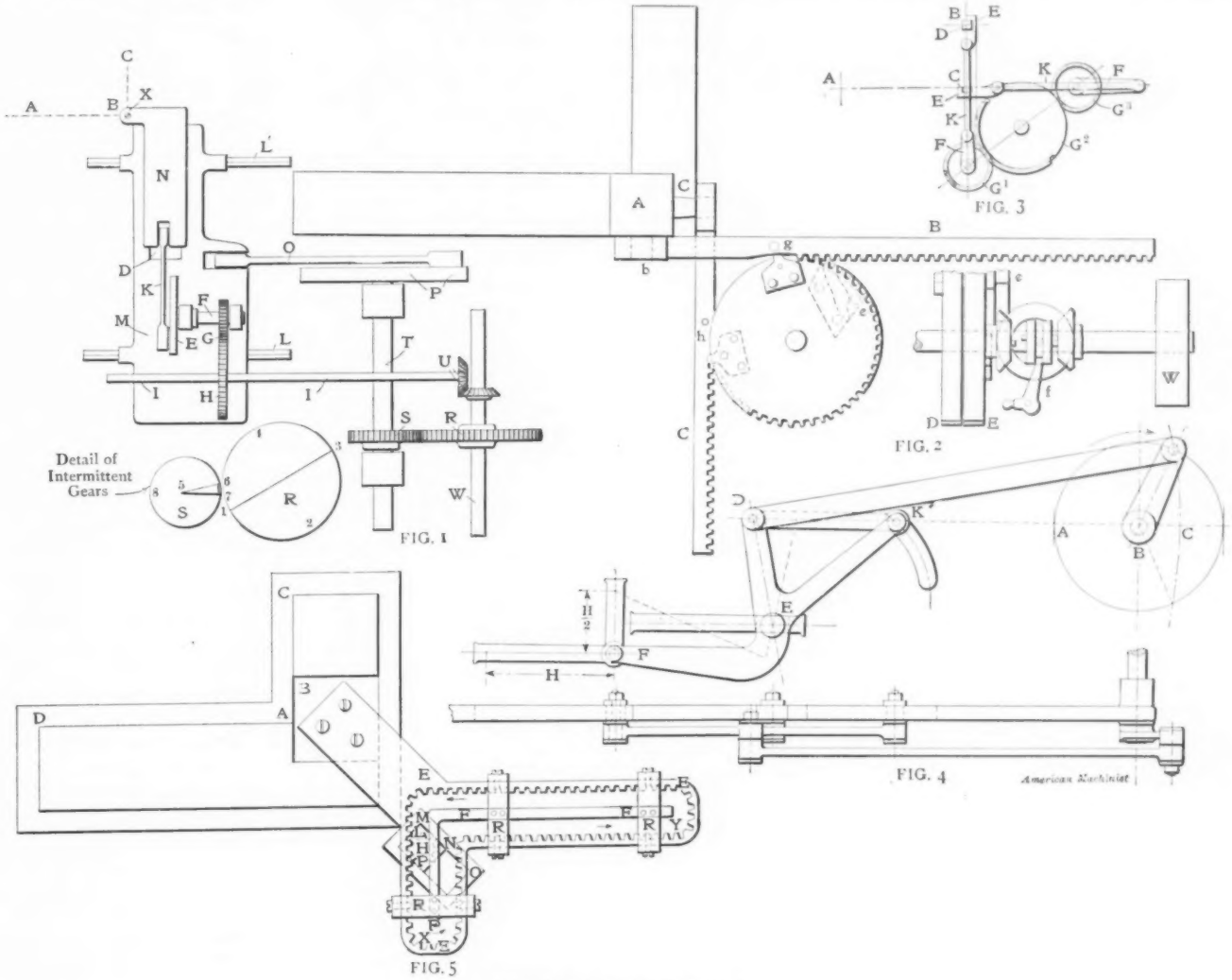
K. D. White, Rose Polytechnic Institute.—This appears to produce a dead

point in turning the corner. The cam movement, however, is interesting as differing from any employed in other solutions.

The following solutions would have proved interesting had the tilting of the block while near the angle been provided for: A joint solution by Charles A. Melchor and R. W. Kancher, Reading, Pa.; E. H. Powers, Midland, Mich., and one by Guy B. Petter, Yeovil, England. Several communications were sent without complete address on the drawing as well as the accompanying text.

or to confirm my misgivings. Mr. Bickford writes:

"My device consists essentially of an internally toothed rack of the shape as shown at *E*, and attached by means of screws or bolts to the block to be moved; of a toothed gear or pinion *P*, a shaft *H*, the length of which should be at least fifteen or twenty times its diameter; a bar *F*, supported by brackets *R*, which are attached to rack *E*; a block *L* to serve as a bearing for shaft *H*, and a frame *M O* to act as a guide for bearing *L*. Let the diagram be a plan of the device, then at the end of its journey in that direction; then the upper end of shaft *H* will travel (relatively to the rack) toward the right, as indicated by the arrow near *X*, but really it will travel in an oblique direction until the right-hand corner of the bearing L comes to point O, thus bringing block *B* on its forward journey a distance equal to the vertical (not oblique) distance from *N* to *O*, the rack continuing its forward trip until shaft *H* is in the corner of the bar F, when the rack and block *B* will begin to move toward the left, *H* keeping its position until it coin-



SOLUTIONS OF PROBLEM NO. I.

SOLUTION NO. 21, FIG. 4, O. S. BICKFORD, GREENFIELD, MASS.

If anyone will take the pains to search the United States Patent Office Records, he will find that "Bickford" stands for many ingenious inventions. Mechanical ingenuity seems coupled with the name, and I am therefore not surprised to learn that the gentleman who sends this solution is a designer of machinery for Wells Bros. Company. As to his ingenious solution being entirely satisfactory I am, however, doubtful; but I have decided to give it the benefit of the doubt, and present it, as it will prove a good study. I hope others will be able either to dispel

shaft *H* should have its lower end supported in a position vertically beneath its upper end, when the block *L* shall be in the mid-position of its frame. The bar *F* is held in such a positon that its lower surface is on a level with the upper surface of the rack *E*, thus allowing the pinion to extend under it, while the shaft *H* extends up thru the pinion *P*, and rests against the bar *F*. The shaft *H* is driven by a pulley placed just above its lower bearing. Starting at the position shown, let the pinion revolve in the direction indicated, and the shaft will remain in the same position until the point *X* comes over point *H*, when the block *B* will be

cides with point *Y*, when it will move backward in the rack and obliquely to the left in its frame until corner *L* reaches point *M*, when block *B* will be at the end of its journey in that direction and will now travel toward the right until the upper left-hand corner of the rack reaches *H*, when both rack and block move forward to the starting point shown in the diagram. The arrows near the leters *F* indicate the direction (relative to the rack) followed by *H* in its path around the bar *F*. I think by increasing the size of pinion *P* the motion of the block would be sufficiently rapid to fulfill the conditions of the problem."

SOLUTION NO. 22, FIG. 5, LAWRENCE E. CUTTER, MOUNTAIN VIEW, CAL.

The crank revolves continuously in one direction, the crank pin being connected by a rod to the end D of a bell-crank lever, which is pivoted at E to a slider moving in a horizontal slot with its center line, extended, bisecting the vertical portion of the path of the square slider, whose required motion is given. The bell-crank lever is pivoted at F to this square slider, moving in guides parallel to the path of its geometrical center. To prevent the slider at F from pressing too hard against the guiding ways, the bell-crank lever has a roller connected to it at K as shown, and moving in a guide, partly horizontal and part curved to give the required vertical movement to the slider at F. The point K, the slider F being still in the horizontal guides, is located on a horizontal line joining the points D and B, B being the center of the crank shaft, K being so located that the motion it tends to have may prevent binding while the slider F is moving horizontally. If H equals the movement required in the horizontal direction, $\frac{H}{2}$ equals the movement required in the vertical direction. Then for the same *average* speed in the two directions the crank must turn thru twice the angle in producing the horizontal movement as in producing the vertical movement, or the angles are 240 and 120 degrees. *Neglecting the angularity of the connecting rod,* the distance $B\,C$ should equal $\frac{1}{2}\,A\,B = \frac{r}{2}$ where r equals the radius of the crank circle.

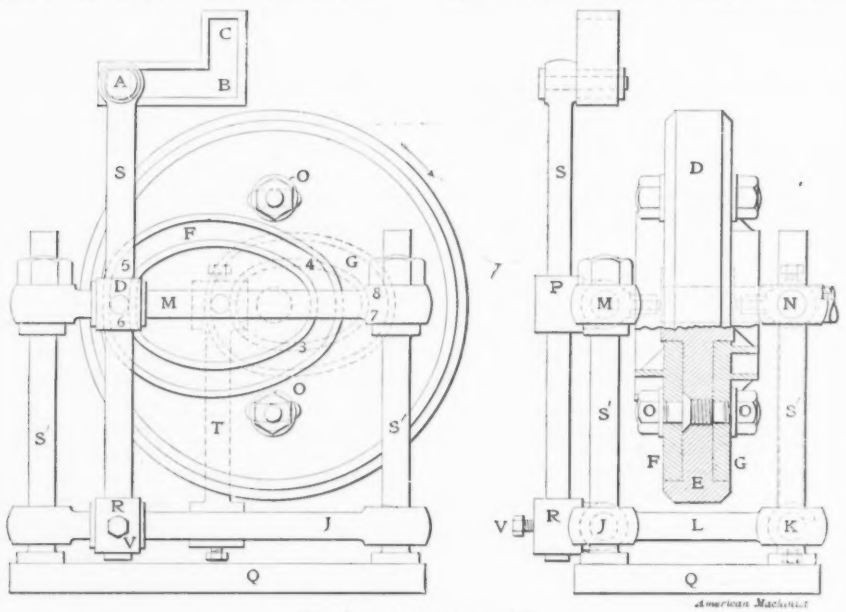


FIG. 6. SOLUTION NO. 23.

The distance $A\,C$ = the distance moved in horizontal direction $= \frac{3\,r}{2} = H$. Then $r = \frac{2\,H}{3}$. Also, the movement of one end of the bell-crank lever a distance $= \frac{r}{2} = \frac{H}{3}$ must move the square block a vertical distance $\frac{H}{2}$. Therefore the distance $D\,E$ is to the distance $E\,F$ as 2 to 3, for the same average speed in the horizontal and vertical directions.

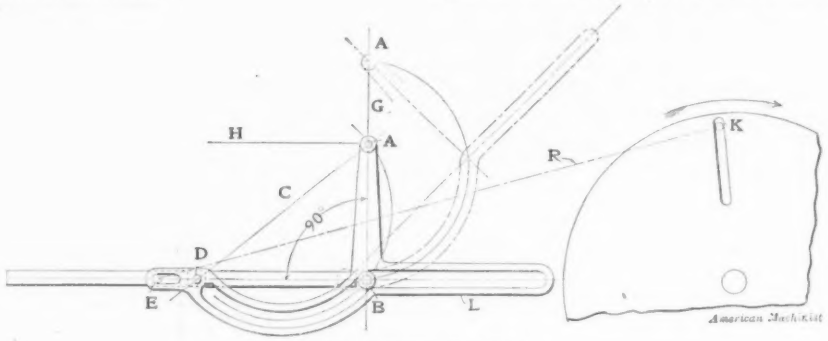


FIG. 7. SOLUTION NO. 24.

SOLUTION NO. 23, FIG. 6. H. POLLARD, PAISLEY, SCOTLAND.

In the following fine solution Mr. Pollard calls the sliding block a die, and his solution, by his general design, shows that its use as a die was uppermost in his mind. A very strong and powerful construction is possible which could be applied to bending, shaping, embossing and other mechanical operations where the resistance to the movement of the sliding block might be heavy.

"The required motions are obtained by double cam wheel rotating in the direction indicated by the arrow. The cam wheel D consists of three parts, the wheel proper E, and the cams F and G. These cams are recessed into the wheel D, one on each side of the wheel, but each free to turn in its recess for adjustment when the nuts O which hold it are loosened. The cam wheel derives its motion from the shaft H. In the base plate Q, one at each corner are rigidly inserted four guide columns S'. The rod J slides on the two side guiding columns, and the rod K slides on the opposite columns, these two rods being connected by the link L at the bottom, so that these rods and the link move synchronously and symmetrically. The columns are steadied at the top by brace rods or tie rods M and N. These tie rods also act as guides for P and R, which slide on them horizontally. A rod S is connected with the die A and extends down thru P and R, working freely in P, but made fast in R by a set-screw V. Now P being in the center of rod S, a force applied there will pull it along and move A and R with it. When it reaches B the bottom rods $J\,K$ and link L (all connected together) are then raised, the rod S carrying the die at its end will move up to C. It is only necessary to reverse the operations and the die will be brought back to its former position at A. If the cam be now revolved from 5 to 6, this arc being concentric with the cam shaft, the die remains at rest. From 6 to 3 it draws P along M, bringing with it the die. As soon as 3 is reached, the back cam G comes into action, and from 3 to 7 lifts the bottom rods by means of the link T, and raises the die to C, the cam F during this operation holding P still by the concentric portion 3 to 4. After another interval of rest from 7 to 8, the die is lowered by rotation of the cam from 8 to 4, where the other cam F again comes into action and completes the final operation by moving the die to its former position at A, which in the meantime has been held tight down by the concentric portion 4 to 3 on back cam G; then after another short interval of rest it starts again on its journey to C. Success in turning the corner B without stopping depends solely on starting the cam G at work immediately the other one has finished, and this is only a matter of accurate adjustment of the two cams by revolving them until each is in the proper position, and then tightening down the lock-nuts O."

SOLUTION NO. 24, FIG. 7, D. MC L., GLASGOW, SCOTLAND.

Mr. McL. requests the suppression of his real name, for sufficient reasons. His solution depends on the fact that the angle contained in a semicircle is a right angle. H and G are the horizontal and

vertical paths, and *A* is the moving point. C is the center of the semicircle *A B D*. *D* and *A* are on the same diameter. The link is slotted to work on the roller *B*, whose center is fixed vertically under the path *G*. The link *L* is reciprocated by the crank and connecting rod *R*, and the length of the stroke may be adjusted in the usual way. *D* slides between guides parallel to the path *H*. These guides, the roller *B* and the straight part of the link when in the position shown, are all on the same center line. As shown, *A* has completed path *H* and will now ascend vertically on path *G*, and on the return stroke will move over the same paths.

"The condition that there must be no pause at the angle is fulfilled. *E* may be shifted in its slot to alter the length of path *G* in relation to *H*. If, instead of a semicircle *A B D*, a segment greater or less be taken, the angle between the paths may be made any size within practical limits. Possibly some modification of this arrangement might be made to obviate the excessive overhang of the link when *A* is at the top of the vertical path. Then guides on the paths would scarcely be necessary, thus eliminating one cause of shock. Or the vertical guides only might be used, but widened out at the bottom, so that *A* would not hit when turning the angle. If two links were used side by side in parallel planes, and stayed together, the whole would be fairly rigid."

This solution may serve to recall a remark made in the first article of this series, calling attention to the analogy existing between inventive reasoning and the logic of geometry.

There remain some solutions of Problem 1, including my own, yet to be presented, but I hope we shall be able to get thru with it and commence on Problem 2 in the next article of the series.

Brass rolling mills are frequently subjected to much annoyance by receiving orders for rolled gun metal of the well-known Government mixture of 88 parts of copper, 10 parts of tin and 2 parts of zink. When the customer is informed that it cannot be rolled he is reluctant to believe it. It is a fact, nevertheless, that this mixture cannot be rolled, as it is too hard. The limit of rolling in the copper and tin alloys lies at a content of about 8 per cent. of tin.—*Brass World.*

Many, many years ago salt was so hard to obtain, but so necessary to have, that Roman soldiers were paid part of their wages in salt. Now, the Latin word for salt is *sal*, and from that came the word *salarium*, meaning salt money. Finally the soldiers were paid only in money, but the term *salarium* was still used to designate these wages. From this old Latin word comes our English word salary. Do you see, then, why we say of a worthless fellow that he "is not worth his salt"?—*Origin unidentified.*

Echoes From the Oil Country—The Cost of Castings.

"Say, I would like to have a little information if you will give it to me." This was from the boss molder. "You know you send me a little slip every month showing how much time is put on castings in the machine shop which afterward you have to throw away. Now, all of that work counts against me, of course, and I haven't any kick coming about that, but what I want to know is whether I receive any credit for the work I do on account of patterns that are not right and have to be fixed?"

It was the superintendent who was being talked to, and as he always encouraged the fullest discussion of all shop subjects among those who were helping him to get out the work he was not a bit surprised by it. He simply wondered what particular thing had led up to the remarks. He knew from former experience that there had been a starting point somewhere.

"I am not so very sure about your receiving any credit for such work, any further than I give it to you in my mind. You see, there are some people who still do not see things in their true light, even after I have done my best with them, but what is the reason that led you to think of it now?"

"I got the last statement just as we were having all sorts of trouble trying to get things to come as fine as you want them on that new lot of patterns. They are rather intricate and it has taken quite a lot of time to make little changes so that all of the cores come as they should, and while the patternmaker is gaging up things the molder is standing around and his time is running on. I think I should charge that time to the pattern shop just like the time on the defective castings in the machine shop is charged to me."

The superintendent laughed. "You've been hit and so you want to hit someone. Is that the idea?"

The foreman nodded his head in the affirmative and added, "And why shouldn't I? Each department should carry its own share, or, if not, why not?"

"Before I go into that I will tell you of my desire to keep you posted as to how much extra work you could afford to do on some lines of castings if by doing it you could prevent useless work being done in the machine shop. You get an account as to why the castings are thrown out, as well as the amount of time that is spent on them. From this information you can form a good idea as to whether it will pay to have more time put on the work by your men in the effort to cut down the amount of the loss in the machine shop, or whether the extra work you would need to do would be so much more expensive that it would be better to let it go on.

"The relation of the pattern shop to the foundry is different from that of the foundry to the machine shop. If I were keeping costs in the office and were allowed to do it my way the work of the two would all be figured together. I might keep them separate for some purposes, just as we keep the work done by one molder separate from that done by another one, but in figuring up the cost of castings I would not make any distinctions."

"It would be pretty tough if I had to stand for all the blunders of the patternmakers as well as my own. I can make enough without that." And he laughed at the idea. "In that case I would get credit for the new patterns, would I not?"

"Not if I had my way you wouldn't. The cost of making them and all of the other costs of running the pattern shop would be charged against you and the only credits would be for work that was done by it for outside parties who paid for it. All of the material, labor and supplies used in the pattern shop that did not go on such jobs would be charged to the foundry just the same as the rest of things used in making castings."

"I am glad you do not have everything your way, then. Just think where I would be with my costs if all of those patterns were charged against me! You are clear off on that all the way thru. Why, the patterns this company owns are worth thousands of dollars—or at least they cost that—and it would show mighty poor management on someone's part if the patterns are not worth at least as much as it cost to make them. Now, you talk of charging them to the foundry. Who would receive credit for them?"

"Just you suppose now," said the superintendent, "if you have a good imagination, that I own this entire business, and that I am running it to make corn shellers. I don't want to sell it, and neither do I have to make a fine showing to a lot of part owners who do not know anything about it except what can be put on a balance sheet. I do want to do a safe business, and to do it I want to know just what it costs me to make corn shellers.

"I keep some books of course, and those books are useful in telling me how much I owe people and how much people owe me, and a whole lot of other things that I need to know. Do I credit myself with the cost of those books and the wages—excuse me, the salary—I pay to the bookkeeper? Surely not. All of the office expense is charged, as it should be. That work is of use to me only. I have to pay for the books and the labor some time and so do it as I go. When I have the pattern shop make a set of patterns for the corn sheller I have been to an expense that was necessary in order to get out castings just as the books were an expense necessary in keeping track of the business. Neither the books nor the patterns are of value to anyone else. If I do not get enough value from their use to pay their cost it was a poor business move having either of them. When the books are full I have to go to further expense getting others, and I can't sell the old ones for anything, so they never bring me anything except that which

comes from their use. When the patterns are worn out I have to make others, and all I have ever gotten out of them has come from their use just the same as with the books. Why should I try to deceive myself with the idea that I have something valuable when I have not. If those castings don't pay for the patterns they will never be paid for, any more than the office expenses will be if I can't get it out of the price the corn shellers bring. While I am at it I would go a step further and charge all of the time of the draftsman that is necessary in making drawings for the patternmaker to the cost of the castings by way of the pattern shop. The machine shop would get the part that was caused by drawings necessary for their work, and the only general expense would be that caused by designing, and there wouldn't be any assets in the drawing-room except the furniture and the unused supplies."

The boss molder did not seem to be altogether convinced as he answered. "That doesn't sound so very bad to hear you tell it, but if the idea is right, why isn't that the way it is generally done? I never knew anyone to do it that way. Did you?"

While the superintendent had to admit that he had never known anyone to carry the idea as far as he thought it should be carried, he still believed the principle was sound. "There are lots of people who like to fool themselves into thinking that they are making money when they are not, and there are a few more who are willing to deceive others when they themselves know better. Did you never see a man who had a store full of goods that he could not sell? Oftentimes he thought he was making money up to the time that the sheriff took charge, and often even after that you would hear him telling how rich he would have been if So-and-So hadn't taken advantage of him when he happened to be a little hard up. The sheriff may not have been able to get enough to pay thirty cents on the dollar of his debts.

"I am only a mechanic, but I never got anything for nothing and never expect to. If someone wanted to buy my business, patterns, drawings and castings are alike worth what it cost to make them if they are in active use, but if I want to know if I am doing a safe business the castings alone have a cash value. But see here now," said the superintendent, looking at his watch, "You and I had better get to work instead of discussing metaphysics, or the company may begin to think that we are not to be classed among the valuable assets." And each one went his own way.

W. OSBORNE.

The hook and ladder truck holds an important and prominent place among the apparatus of American fire departments. In Austria they have hook-ladder trucks which carry ladders with large hooks that will reach over a thick wall or cornice.

Letters to the Editor.

Facing Locomotive Shoes and Wedges.

We do not often hear from the locomotive men thru your paper, either because they are too busy or because they think their work is too coarse to be interesting.

I enclose herewith a sketch of a little device that I got up to use in facing up locomotive shoes and wedges on repair work. It is our practise in laying out this

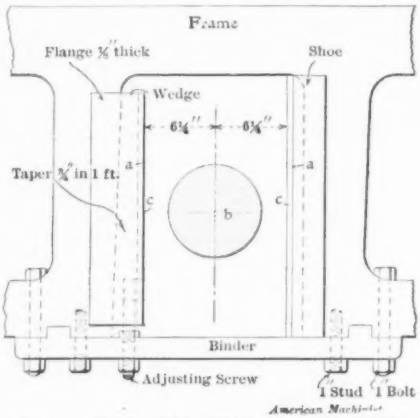


FIG. 1. SHOE AND WEDGE IN LOCOMOTIVE FRAME.

work on the pits to scribe a line as at *a*, Fig. 1, on each side of the shoes and wedges at such a distance from the centers of the driving axles *b* that the faces *c* of the castings between which the boxes slide shall be just ½ inch from these lines when planed. This practise may or may not be common, but it has the advantage of always showing your reference line after the cut is taken.

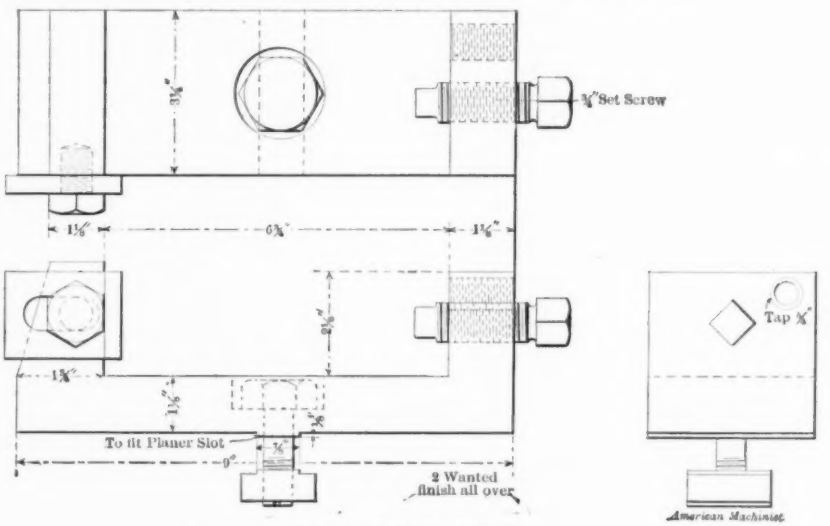


FIG. 2. PLANER CHUCK.

The chuck shown in Fig. 2 will explain itself. It is made of a steel or iron forging and finished all over. Two are used to hold the work and, as the cuts are usually light, no stops are necessary. Two small jacks are used inside of the shoes to keep the flanges from springing under the pressure of the set-screws. The work is leveled up by the reference line previously mentioned.

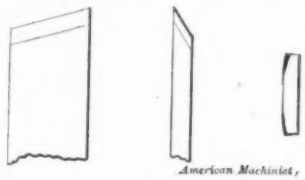
In facing up wedges no jacks are needed inside, as the extra thickness of the back at the lower end of the wedge brings the set-screw bearing on solid metal and at the upper or thin end I simply change the set-screw into the other tapped hole.

E. W. MOREY.

A Scraper.

The cut shows three views of a scraper cutting edge which is an exceedingly rapid cutter, and can be used in close quarters and deep depressions.

The cutting edge presents an angle of 75 degrees with the side. This angle is



A SCRAPER.

important and dare not vary more than a few degrees either way to preserve its greatest cutting efficiency; this allows an acute cutting edge angle of 60 degrees and will not chatter. The extreme point of cutting edge is slightly dubbed and rounded off a short distance in from the end at right angles to the sides to prevent digging in.

The under side is slightly rounded and "set up"—to use an engraving term—the set being determined by the depth of the depression in which it is to be used or the inclination at which the user wishes to hold it on a flat surface.

This tool is for roughing and was used by me to cut out 1,200 names embossed on tin-plate forms which had been previously flattened down. The maximum speed was one name—covering a space of ¼x1 inch to a depth of about .004 inch in a 7-32 inch depression; area ⅝x2 inches in one minute. This scraper can be used

to advantage by grinding it either right or left.

Reading from left to right the views are: Top view, side view, and end view.

C. E. REGENNAS.

A Box Tool.

Having to make a few small screws occasionally, I fixed up a box tool to fit in the tail spindle of my lathe, and have found it very handy. Some of the features are old and well known, but my impression is that there may be some novelty in the method of setting the cutter to produce a given size of screw shank. The tool is shown complete in Fig. 1.

The gray-iron casting *A* is driven on the steel shank *B* to stay, *B* having a hole entirely thru it for the stop rod *C* that determines the length of screw to be made. After this, a hole is put in for the binder *D*, shown in section in Fig. 2. The hardened bushing *E* for guiding the stock is held in place by the pinch screw *F*. The cutter *G* rests on hardened collar *H*, and is held in place by binder *K* and screw *L*, shown in section in Fig. 3. The cutter *G* is made of square steel, hardened its full length, after which its leading side, and the side that rests on collar *H*, are lapped flat and square with one another. The cutter is always sharpened by grinding the end, which is ground square with the side that rests on *H*, and at an acute angle with the leading side of cutter, the acuteness of this angle determining the amount of rake the tool will have. By twisting around the binder *K* the clearance may be altered to suit the notions of the user, or the material that is being operated upon.

The size that the tool will cut is governed by the thickness of part *H*. Such collars are comparatively easy to make, and never wear out, so it is not much of a burden to have one for each size of screw that I wish to turn, the one shown in Fig. 1 being for a No. 2 machine screw, and is so marked. The thickness of the first collar is arrived at by first leaving it a little full, then putting in the tool and turning a piece of stock with it. If it cuts .010 over size, reduce the thickness of the collar .005 and it will then be just right. When the collar is hardened it usually swells and leaves a little to lap off after hardening. After getting one correct in thickness, it is an easy matter to determine the thickness required for other sizes of screws, as the difference in thickness of two collars is exactly equal to half the difference in diameter of the screws these two produce.

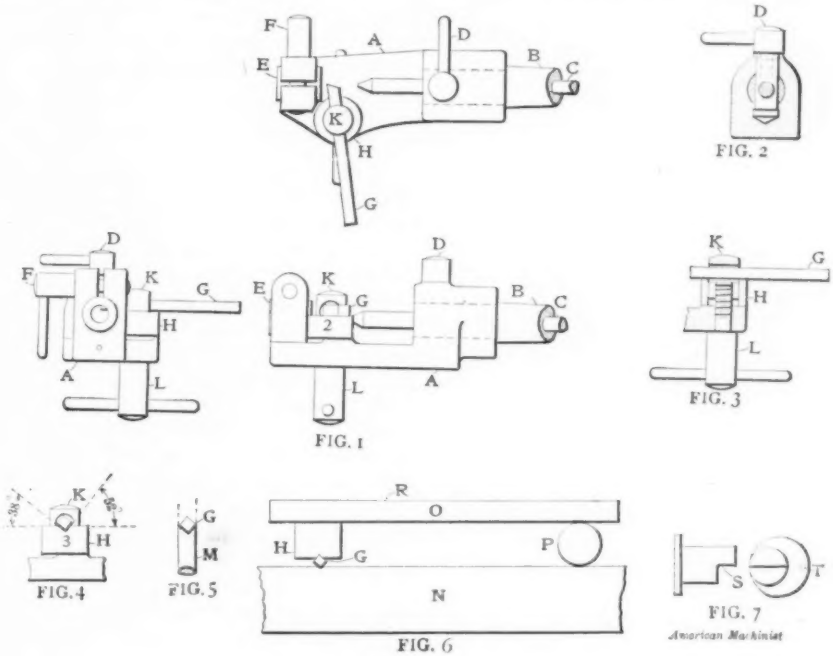
For making countersink screws, I have another set of collars with an angular notch in the top side, as shown in Fig. 4, which tilts the cutter over sufficiently to produce the correct bevel under the screw head. As the bevels on each side of the notch are not equal in amount, it follows that the bottom of the notch must be a little to one side of the center of the collar in order to bring the square cutter about central in the round hole thru binder *K*. These notches were milled in a swivel head milling machine, the work being held in the index head. To get the correct sidewise setting of the milling cutter, I chucked a piece of round brass rod *M*, Fig. 5, of the same diameter as the hole in binder *K* thru which cutter *G* passes. Then I shifted the milling cutter sidewise until it would mill a notch in the end of *M* in which *G* could be laid so that two of its corners would come in line with the sides of *M*, as shown by the dotted lines in Fig. 5. *M* was then removed and the notches milled in the collar with that setting of the milling cutter, feeding in for depth until one corner of *G* was nearly down to the top face of the collar. Of course, in setting up the tool for countersink screws, it is necessary that the following side of the cutter should rest against the steeper side of the notch, and this is provided for by numbering the collars on the side that is more remote from the cutting end of cutter when the tool is properly assembled, and then seeing to it that it is always assembled in this way. I like to make things fool proof when I can, but in regard to this particular feature I did not exactly see my way clear to do so.

The cutter used for making countersink screws requires a small flat on its business corner, which flat must be parallel to the feed, or, what amounts to the same thing, parallel to the face of collar *H*. The way I made this flat was to place a sheet of emery paper on the surface plate *N*, Fig. 6, then rest the cutter *G* on this, the collar *H* on the cutter, and the straight bar *O* on the collar, the other end of the bar resting on any flat or round object *P* of the proper hight to make the bar approximately parallel with the surface plate. Then by a downward pressure in the neighborhood of *R*, and an endwise movement of *G*, carrying *H* and *O* with it, the necessary flat was honed on the corner of *G*. When making the tool in the first place, it is well to hone this little flat before finishing the collars to thickness, but when renewing the cutter, should too much of a flat be made, causing the screws to be above size, it can be remedied by honing off either one or both sides of the cutter adjacent to the flatted corner. The plain collars I left glass hard, but the washers with notches in them I drew to a dark straw color to prevent the cutter from splitting them when forced into the notch by screw *L*.

In regard to the operation shown in Fig. 6, I often use the shank of a twist drill as a distance piece *P*, as there is usually quite an assortment of sizes available, especially under ¼ inch. If a size is wanted between two drill gage sizes, the smaller size with one or two sheets of paper added constitutes a very good makeshift, and if *P* is not exactly the right hight the error arising therefrom may be reduced by increasing the length of *O*.

In assembling the tool after the washer is changed or the cutter is sharpened, it is necessary that the cutting edge of the cutter should be about central. This is accomplished by inserting the case-hardened piece shown in Fig. 7 in place of the bushing *E*, and then pushing the cutter against the flat spot *S* before tightening screw *L*. The dowel pin *T* fits in a small hole in the end of *A* to properly line up the surface *S*. No great amount of accuracy is required in setting the cutter central, as a slight deviation from this position has practically no effect on the diameter of the work produced.

When making steel screws I find it is



A BOX TOOL.

good plan to so place this box tool in the tail spindle that the back end of cutter *G* points down toward the back *V* of the lathe bed, as the oil then drains off nicely from the back end of the cutter, and does not flood the entire tool quite so badly as it otherwise would. WALTER GRIBBEN.

The Draftsman and His Bosses.

I often go thru the bound volumes which I have of the AMERICAN MACHINIST, and am generally rewarded by finding something I have overlooked previously. The things which most interest me, as the head of half a dozen draftsmen, are matters concerning drawing office management. One point I have never seen mentioned is this: Which has first call on the drawing office, the work of the shop or inquiries? The position in our own works is like this: The business is owned and run by three brothers. No. 1 does the traveling, No. 2 is the works manager and No. 3 attends to the business part of the concern, correspondence, inquiries, etc. As matters stand I am allowed a free hand in the drawing office, but am not allowed to choose my own assistants nor to have much say as to how many I need. The difficulty is I have two employers to please, each of whom looks at his own side of the case.

Probably No. 2 will be the early bird one morning, thereby catching the worm as personified by me.

"Now, Nemo, what about that machine of Jones'? When can we have the drawings in the shop?" I quietly point out that this is the first I have heard about it. "Good heavens! you don't mean to say you haven't got the order in here yet! Well, Jim [the foreman toolmaker] wants a jig designed, and John has an idea for a new attachment for the large milling machine; get someone on with them at once, while I go and rout out that order of Jones'."

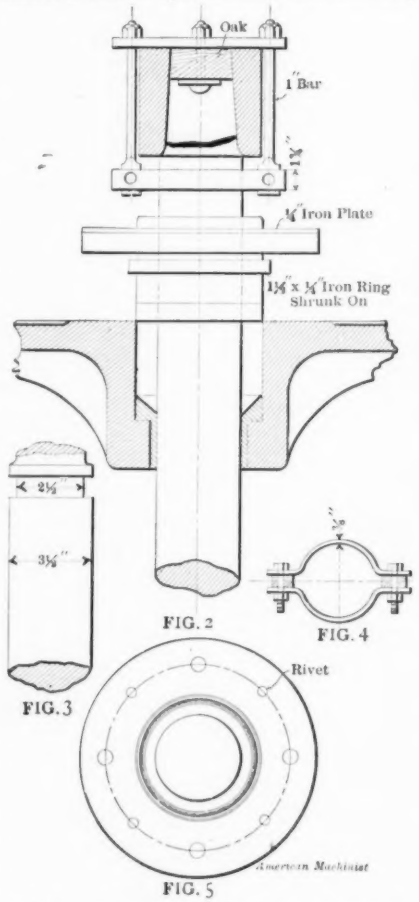
In a few minutes in comes the order clerk with Jones' order, and bearing evident signs of having been "blown up." He tells me that the order came in by the last post the preceding afternoon. Soon after in comes brother No. 3. "Good morning, Nemo; I've a few drawings here I want you to see to. There's one for —— and another for somebody else," etc., until he gives me enough work to occupy all the staff for a day. I point out the impossibility of doing it all, and he indulges in his usual grumble which he keeps in stock for these occasions, touching on the large percentage of non-producers in the shop, etc., finally winding up with, "As I've told you many a time, there's no necessity for elaborate drawings, just send a pen and ink sketch or a lithograph, and tell them we'll send detail drawings if they give us the order. You know what to say; surely you know how to draft a letter without my having to tell you every time."

Sometimes, if we are specially pushed, we obey him, and then in comes brother No. 1. "I say, Nemo, why on earth didn't you send a right drawing to Brown's; fancy sending a pen and ink sketch and telling them we'd send a right drawing if we got the order." Then No. 3 chimes in: "Just what I've said many a time, Jim. I keep telling these chaps that a decent drawing will often make all the difference between getting an order and losing it." Then Nemo goes and looks under the heading of "Help Wanted," to try and get a shift, but they generally come round and are all right again until next time, so that I decide I will try it a bit longer. I therefore want to know what ought to have first claim on the office staff. It's a question I can't answer myself, and I should like to hear the opinion of other draftsmen upon it. NEMO.

Yorks, England.

Air Pump Breakdown at Sea.

We were bound for Buenos Ayres, and had left South Shields with 5,000 tons of coal for the Argentine Government, which meant a run of 6,000 miles, with one stop on the whole course. Fortunately for all on board, the "Tramp" happened to be one of the old-timers, well built, with triple-expansion engines; cylinders, 22, 36 and 59 inches; stroke, 39 inches. The boilers consisted of four single-ended, multitubular, Scotch type; three with furnaces in each, consuming 19 tons per day, and steaming at the rate of 10 knots per hour. We came down the North Sea in fine style, clearing the English Channel and rolling into the noted Bay of Biscay, but fortunately the sea was like a mill pond. Eventually we reached St. Vincent, Cape Verde Islands, and took on board 180 tons of bunkers. At 5.30 P. M. we cleared, outward bound, for the South



REPAIR ON AN AIR-PUMP GLAND AND ROD.

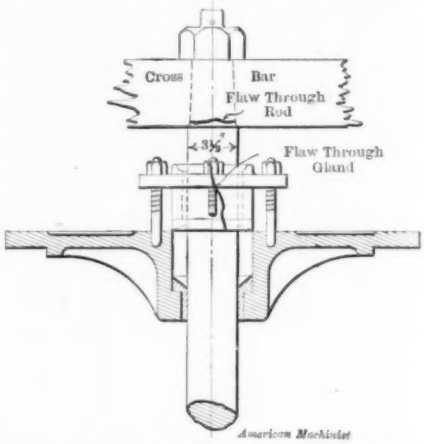


FIG. 1. BREAKDOWN AIR-PUMP GLAND AND ROD.

American Republic; but unfortunately we were brought to an unceremonious stop six days from the "line" by our air pump breaking down. There happened to be a swell on, and as we had no governor for regulating the supply of steam, the engineer on watch had to resort to the throttle valve shutting and opening out according to his own discretion. But she raced once too often, and a heavy thud at the back of the engines, where the pumps were situated, told a tale without words. The engineer on watch eased her up "dead slow" until a few seconds afterward, he caught sight of the vacuum gage falling to zero. The throttle was closed, and the "faculty" gathered around the scene of the accident, which consisted of a broken pump rod and cracked gland, as shown in Fig. 1, with no duplicates on the ship. All our pumps, consisting of two feed pumps, two bilge pumps—both plunger type—one air pump and one circulating pump, were attached to the main engines, run by the usual lever arrangement from the low-pressure engine; all connected to a crossbar, the latter attached to the pump levers by the well-known double-link arrangement. We had a good way to go before reaching port, so the chief came to the conclusion that his subordinates had to make a "good job of it." All the pumps had to be disconnected from the crossbar, and the latter swung over clear, and held up by rope blocks from a beam overhead. We took the gland cover, head valve and bucket out of the air pump, and disconnected the rod from the bucket, then laid the rod on some blocks, chalked and marked it near the fracture and cut a groove all around, 1¾ inches wide by ⅜ inch deep, as shown in Fig. 3. Meantime the third engineer, who was a bit of a

blacksmith (as all tramp engineers have to be) made a wrought-iron clip, as shown in Fig. 4. We fastened it on temporarily and found that there was ⅞ inch space between the lugs on each side, so an inch bar was procured, the ends heated and jumped up on the anvil, then forged out and a ⅝-inch bolt hole punched thru. The opposite ends were threaded and connected to an iron plate over the top of the crossbar. A circular oak block was turned up in a foot lathe, which we luckily had on board, and a bolt—minus the nut—driven thru a tight fit, then inserted in the crossbar, as per sketch. The gland was repaired by riveting a plate across the top, as at Fig. 5, and prevented from springing open by shrinking a 1½x¼-inch iron ring on, as in Fig. 2. When we had everything coupled up and the gland just entered in the stuffing box, the engines were turned over by the turning gear until we had the air pump at the end of its stroke. On measuring the clearance between the clip and top of the gland we found it to be 2 inches, so the gland was tightened down on the new packing, which had not been compressed, and we gained another 1½ inches. The lugs of the clip came between the studs and did not interfere at all. Eventually we made another start, and to our satisfaction arrived in port without any further accident. The chief engineer of the line had orders not under any condition to get new work abroad if the engines would be able to run by patching. Rather than forfeit his position thru a detail the chief ran the ship home. The thanks he received on reporting at the office were: "Will she run out to Bombay this time? We will order a new rod for your next voyage." But the danger of doing so was explained, and after a great deal of grumbling a new rod and gland were obtained, but the old rod and packed gland remained on board as a duplicate. Tramp companies would save a fair percentage upon the total cost of running a ship if they would only be a little more free with duplicate sets.

E. J. G. THOMAS.

Hight and Size of Stack for Air Furnaces

I was much pleased and interested in the article at page 28 about air furnaces for melting gray iron. Dr. Moldenke, however, does not give any rule or estimate for the hight of the stack. Would he consider 60 feet high enough, or might it be more or less? The only note I can find calls for 40 feet of stack, and practise seems to be so varied that one cannot be certain as to what to follow.

W. L. CLOUSE.

[To the above Dr. Moldenke kindly replies as follows.—Ed. A. M.]

For air furnaces with forced draft 40 feet is ample for the stack hight, but these stacks must be very large in cross-section to let off the gases blown thru them. In fact, one will see many such chimneys in old malleable iron works, invariably square, and some 6 to 10 feet outside measurement. In these days of progress, however, especially where within city confines, higher stacks are used, and they can preferably be iron ones, lined with 4 inches of fire-brick for the upper half and 9 inches below. I would recommend, say for a 6- to 10-ton furnace, a 70-foot iron stack 4 feet inside the lining. This will be ample, and not too costly.

RICHARD MOLDENKE.

Triple-Splining Long Shafts.

A splined shaft, ten feet long between bearings, driving a sliding head which precluded intermediate supports, gave trouble by bending and running like a skipping-rope, when at its required speed, about 900 revolutions per minute.

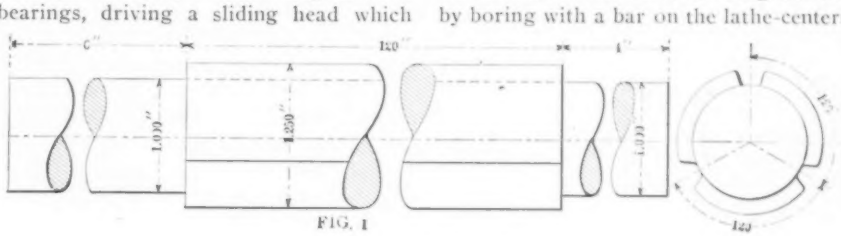


FIG. 1

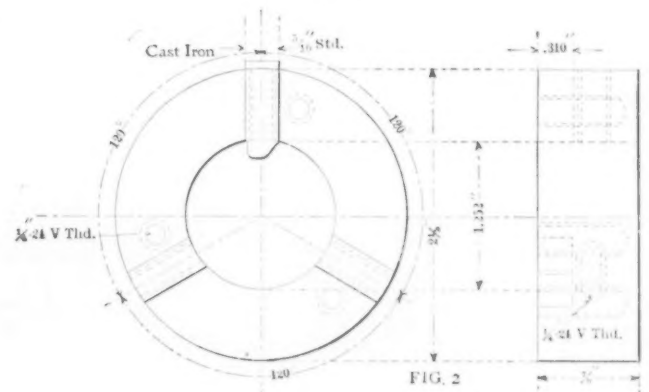


FIG. 2

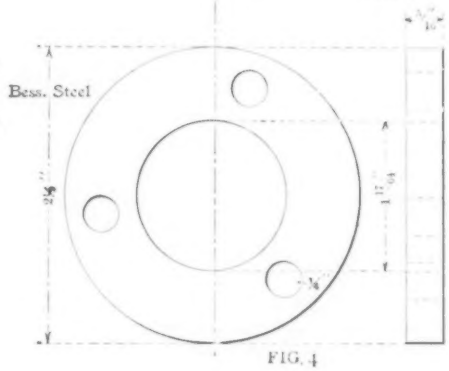


FIG. 4

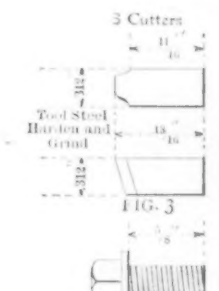


FIG. 3 FIG. 5

American Machinist

THE SHAFT AND THE TOOLS FOR SPLINING.

This was attributed partly to its lack of balance, due to the single spline in so long a piece.

Hence it was decided to try a shaft with three splines, as shown in Fig. 1, with a three-pawl ratchet to engage them.

To divide the drive, it was necessary to have the three splines equally spaced, and to combine smooth gripping action with strength of parts, the shape shown was chosen for the splines.

The longest planer available had a 7-foot table, and the longest milling machine was no longer, but a 24-inch lathe of 12-foot capacity was at hand. Therefore, the splining fixture shown in Fig. 2 was made, with the cutters, Fig. 3, held in by the cap, Fig. 4, and adjusted by the collar-headed screws, Fig. 5, which were used to hold the cap also. The fixture was milled in the dividing head to insure truth and accuracy of spacing, while the cutters were planed with a forming tool, making them all alike.

To carry the fixture, a suitable holder was made, the hole in this being finished by boring with a bar on the lathe-centers, so that it was known to be in line, the holder being bolted to a follower-rest of rigid pattern, designed, cast and finished especially for the job, but so as to be useful on regular work.

Then one of the shafts was put on the centers, and securely fastened to the tail-spindle, which was clamped tight. The splining fixture being in place, the tools were inserted as shown in the sketch, fastened by the cap, and adjusted to clear the shaft.

The lathe was run, the lead-screw being geared up to give as fast a carriage travel as was desired. The carriage in this way

was driven by power the length of the shaft, while the cutters were fed down by the adjusting screws, little by little, until the desired depth was reached.

In this manner the shafts received three splines, all alike, and equally spaced.

H. V. PURMAN.

Commutator Work.

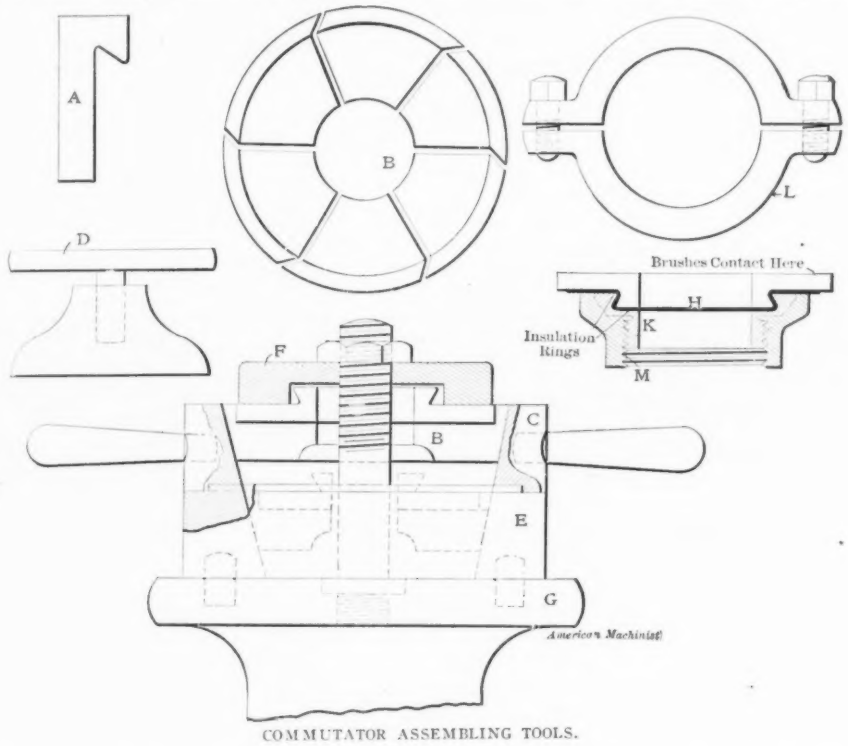
This article with accompanying sketches gives some points in connection with the manufacture of a commutator for a single-phase automatic self-starting alternating-current motor as made by the Century Electric Company, of St. Louis, Mo. A great many articles have been written relating to the methods of manufacture and design of commutators, but I believe that all of them have been on the subject of commutators for direct-current motors. The design of this type of commutator does not vary much and it is more generally understood than the commutators for alternating current, which is a very different proposition.

To begin with, it is necessary that the commutator department be a very clean and well-lighted room. If dirt, chips, etc., are allowed to accumulate on the benches, they will of course get in the insulation, and if the commutator is assembled under such conditions it will no doubt break down under the test. This means a great expense in locating the trouble. To obviate this I have evolved the following system, which has given satisfactory results:

1. All the insulation is thoroughly inspected by a competent man to see if it contains any foreign matter which might cause trouble.

2. All the machined castings are washed in gasoline. Those that contain blow-holes are drilled and scraped so as to remove all sand, dirt, etc. Commutators of all types, if assembled under dirty and loose conditions will sometimes pass the test and be considered all right after they have been driven on the armature shaft and the armature leads are all connected and soldered. The final test is then made and short circuits and grounds are found. The reason of this, I have found, is that the spool or head contained chips and dirt which did not show at the test when the commutator was assembled because it had not been moved enough to dislodge these chips. Driving it on the shaft loosens the dirt and chips, and if these cross two or more segments we have the trouble of short-circuits. It will be seen then that to get rid of these it would be necessary to remove from the shaft and a great many times to rebuild the commutator, which would be a very great expense and delay. Micanite rings for insulation have been found to contain small nails and pieces of sheet metal which were pressed in the ring when it was formed and which would pass the ordinary employee unnoticed. By having a competent inspector whose sole duty is to see that all machined parts and segments are cleaned, all insulation inspected before going to the assembling bench, and a report made to the foreman on each lot for the purpose of keeping a record, I have been able to manufacture these commutators with very satisfactory results. The commutator being one of the most important parts of an electric motor of any type, it will be seen that too much care cannot be exercised in its manufacture. A few sketches of the tools used in this work may be of interest, as the method employed is entirely different from that for direct-current commutators.

A is the segment, it being punched from bars of hard-drawn copper; the pure mica insulation segments also being punched with the same die. *B* is the assembling-jig bushing, which is cut into six equal parts. This bushing is placed in the top ring *C* of the assembling jig, and the segments with their insulation are assembled in the bushing. As they are quite loose now, they are painted with shellac which flows between each segment. The top ring is then lifted from the revolving table *D* and placed on top of ring *E*. A collar *F* is now put over the screw. This collar bears on the segments, pressing them thru the top ring into the bottom one (as indicated by the dotted lines); these rings being bored taper, the bushing as it passes thru presses together the segments, making them tight. The top ring is then removed and the bottom ring containing the segments is placed in an oven and the work baked for 10 minutes. It is then taken to the bench and placed over two pins on the stand *G*. The insulation rings are now placed on the segments and shellacked. These are shown in the completed commutator at *H*. The brass V-ring *K*, which is sawed in two equal parts, is placed over the segments and pressed together by the clamp *L*. This is to allow the malleable iron head *M* to be screwed down over the brass ring on to its beveled surface. The clamp is removed, after the head has been screwed on a few threads, to allow the head to be screwed to its seat on the ring. This makes the segments very tight. The threads in the end of *M* are for screwing the finished commutator on to the armature spider. The work is now taken out of the bushing *B* and turned in a lathe, and the slot in each segment milled for the armature leads, after which it is tested and sent to the winding department. In this motor the brushes have a rubbing contact on the commutator for only about 30 seconds in starting. As a simple and reliable governor automatically throws them off when the motor gets to speed and at the same time short-circuits the armature, this leaves the only moving part the armature revolving in its bearings.



COMMUTATOR ASSEMBLING TOOLS.

JOS. H. BLAIR.

Chilling Machine-Tool Guide Ways.

I was much interested in the account, at page 271, of the Landis Tool Company's foundry methods, and think possibly it might be of interest to call attention to the differences between their practise and that which I developed in chilling the ways of machine tools.

I am inclined to think that my practise was somewhat better, in that it did not involve the use of chill plates of varying thickness, nor yet introduce necessities for any precaution due to expansion. I simply employed blocks of uniform thickness about 1½ or 2 inches, and instead of allowing the iron to rest directly against these blocks coated them with asphalt and sand. This had the further advantage of giving

a smoother casting and of avoiding the surface striations so often found where hot iron comes into direct contact with cold. I never placed these chills into absolute contact with one another, but left a small space between, and practise showed that this was quite sufficient to take care of any expansion. As a matter of fact, with chill plates of this thickness, they may be placed apart as much as an inch or two without appreciable effect on the work, since their chilling effect extends sufficiently far for the purposes required.

One further use of plates of this weight is that they may be lined up to form guides for other portions of the molds or for the cores without being otherwise secured than by their own weight. HENRY HESS.

Getting the Good of the Whole Sandwich.

Your apt likening of the AMERICAN MACHINIST to a sandwich, in the editorial at page 34, has suggested these few words. You draw attention to the fact that those who do not assimilate the "bread" as well as the meat do not get all the nutriment out of the sandwich. Some readers have an impression that the advertisements are useful only to those for whom they are normally issued—the buyers. One actually hears it declared, as tho it were a detriment, that the AMERICAN MACHINIST is nearly all advertisements. The speakers fail to see that the advertisements, as much as the rest of the paper, help to show the present position of and the practical advances in machine tool construction.

Those who get the European edition have an additional pleasure and advantage—that of comparing the English and Continental pages with the American. Not only is the comparison of design instructive, but the difference in "get up" between the advertisements of some of the older British firms and of those from the States is a surface indication of different business methods.

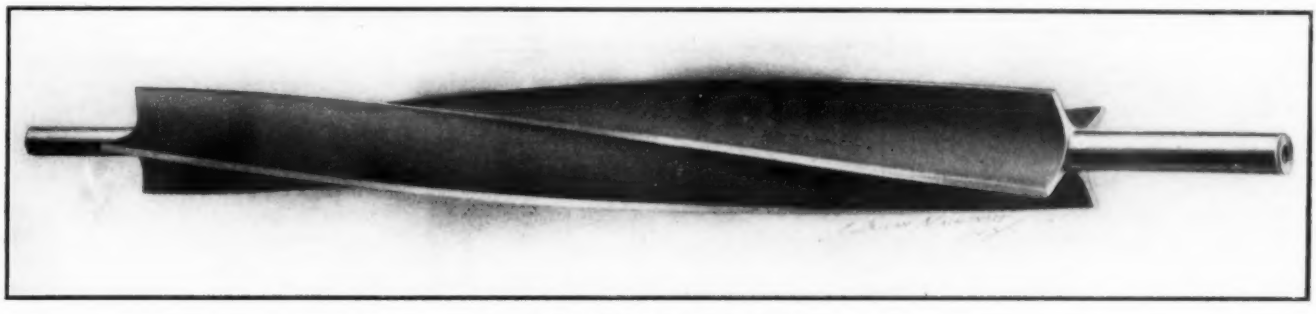
Some time ago I started to form what might be called a universal machine tool catalog. It consists of clippings taken from time to time from the advertising pages of the AMERICAN MACHINIST and other papers, of the most representative machines, showing up-to-date practise, also those showing radical departures from the existing standards. These, it may be noted, are, up to the present, principally high-speed lathes. The different cuts are filed in a large book, most of the pages of which have been removed, leaving just a few to act as partitions between the different classes. Each cutting is dated. I have already got together a good collection of machines, which, to anyone connected with the manufacture of tools, is as interesting and instructive as many of the books published on the subject. Moreover, it covers a broader field. In the distant future the collection should be more interesting still, as showing the "march of progress." It will also show, I think, that fads in design move in cycles. MCANIC.

Manchester, England.

Cutting Spirals on the Planer.

Dixie's article at page 161 interested me very much. The bevel gears are all right for quick spirals, but for long spirals like the illustration herewith, the worm gear seems to be the only way. This spiral was made in the shop of the Philadelphia Gear Works, Philadelphia, Pa. The ends are 3½ inches long each. The spiral part 39½ inches long by 4½ inches diameter. The pitch 90 degrees in 40 inches. The material was 30 carbon steel. The job was done on a 14-inch planer. A worm and gear replaced the bevel gears shown at page 161, otherwise the rig was practically the same. The relief at the edges of the teeth was also planed.

DAMASCUS.



LONG SPIRAL CUT ON A PLANER.

Michael "Hits a Lick" at the Hammerless Center Punch.

Editer Machinis

Not havin anythin to do jest now I thot Id rit an let you no of sum of the things goin on aroun hear. Ted Baxter allways worked roun here when he wuz a yong feller but left bout 8 year ago an went to boston so he could lern toolmakin. he cum back las month, so he cud stay a while with his ole man who aint got many more months to live. Wile hes here he's doin sum tool makin for the elevator Works. He is lots diferunt from the Teddy baxter we knowed 8 year ago. Then he wore overhalls but now he wears a apron an hi coller an hes considerable stuck up too cause hes a toolmaker insted of jest a machinis like the rest of us be. The boys are all the time rubberin at him an they say he got a good educashun when he wuz to boston an now all the boys are studyin an tryin to get a educashun to. A agent from the Corespondince School wuz hear bout a month ago an most of the boys are studyin somthing now. I am taken a corse to be a civil enginere wich the agent sed paid reel high. I hav ben workin hard an am as fur in mathematicks as squar Root.

I hav allways thot I would like to go on the staige or be a Electricul enginere but the agint at first wanted me ter take a corse in sum forrin langwige sayin they had fonygrafts wich would talk the lessuns to me so it would be easy to lern, but I desided to take a corse in Civil Enginerin.

Ole man Lively he does all the scraipin on valves an sich in one of the shops hear an he jest does slick work—looks jest like sum crazy quilt, all sort o patterns. well, Teddy baxter he wuz fittin a spindle in sum bearins las week, an he used sum blue paint he skroudgd outer sum led toob. he tole the boys it wuz prushun blue an red led wuz no use to him. I no ole man Lively allways used red led. Ted is jest stuck up thats all an I want to tell how mean he wuz to me day befoar yesterda.

Gus asked me to stop my machin an take a lath in the tool room an turn up a peice of iron wich he give me. So I goes an puts the peice in a vise in the tool room an pick up a senter punch an took my hammer wich I had brot in with me an wuz jest goin to hit a lick to senter the work when ted thrun a wood block at me an he wuz swarin at me to drop his senter punch an go tell outer his tool room. Yes Mister Editer—thats jest what he sed. I never see anythin so mean, he sed his senter punch dident hav to be hit with no hammer an wuznt fur sich work as I dun, but he dont need think I will ever bleeve him. I hav seen the fellers in the shops roun here run laths fur years and they allways senter the work good with a senter punch an then put it in the lath but sence ted Baxter is back the boys drill in the senters jest cuz Ted does I guess. I dont see no sence in it. An if a senter punch cant stand a lick frum a hammer it aint no good.

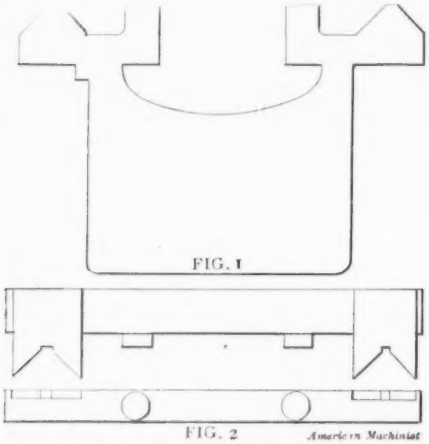
M. LUNKHED.

P. S.—I wuz runnin the big lath las week an the belt wuz loos so I twist it

a few times becuz my job wuz in a hurry. When I wuz thru ted had a big castin to do in the lath, an he cut the laicin an fix up the belt befoar he start his job. I think it wuz *shiftless* the way he cut that lacin an it nearly new. I allways take out the laicins an use them over but I aint no toolmaker you see. MIKE.

Templets for Planing a Lathe Bed.

A templet or gage is first made to prove and secondly to bring work to a standard. The manner in which these gages are made



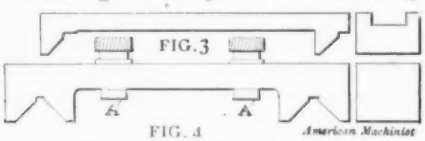
THE BED AND THE FIRST TEMPLET.

often causes a great difference in the time consumed in fitting.

The superintendent was a good mechanic and a nice man to work for, but the shop was new and he had much to contend with. When the better templets were shown to him, he at once allowed them to be made. In Fig. 1 is shown the end view of the lathe bed, and in Fig. 2 the templet first made. This was required to fit the V's and the flats at the same time.

The body of this templet was made of 1x2-inch machine steel, with V's cut in ¼-inch tool-steel plates. One-inch round stock was turned down on the ends and set in to give the hight of the flat bearings, as shown.

In using this templet it was necessary



THE SECOND SET OF TEMPLETS.

on account of its narrow bearings to use a square to line it up across the bed and also vertically. It was a very slow job of cut and try, until the templets, Figs. 3 and 4, were made. After the bed was roughed out, the proper distance from the first side of one V to the first side of the other was obtained by the use of the half templet, Fig. 3, then the other two sides of the V's were finished until the whole templet, Fig. 4, rubbed chalk marks off the four sides of the V's.

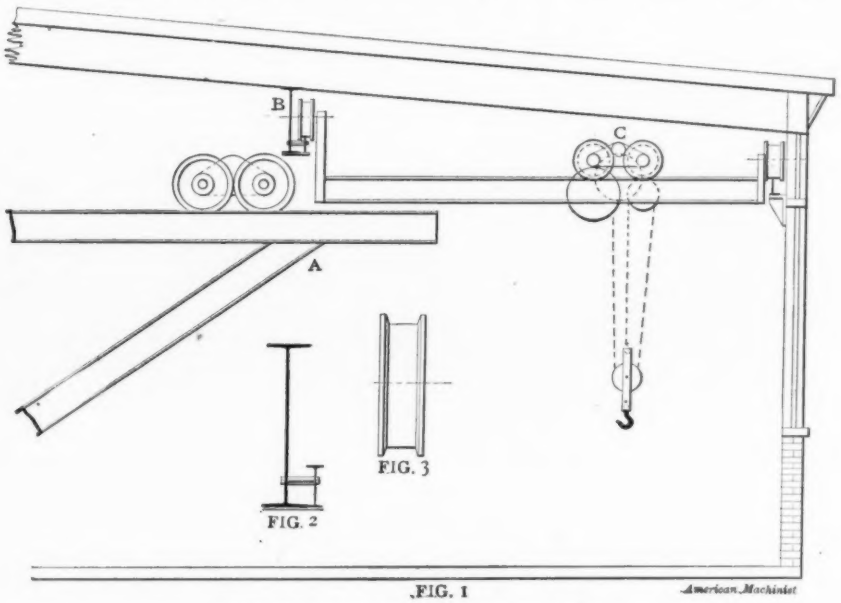
The flat bearings were finished last. The hardened steel plugs *A A* in templet, Fig. 4, were fitted so as to hold paper between their faces and the job. The templet for planing the tool carriage was of course just the reverse to Fig. 4. The saving of time in using the last templet was over 3 to 1. CAMERON.

Locating a Crane Under Difficulties.

When we built a shed-like addition on one side of the shop we were confronted by the conditions shown in Fig. 1.

One rail on which we had to traverse a traveling crane had to clear the jib crane at *A*. On the other side, no matter how high we placed the rail—if we had room for a 12-inch wheel—it was 16 inches below the left-hand rail. We had to save every inch of head room possible, as the place was low at the best.

We designed this crane for a load of 10 tons, tho we never put over a 6-ton hoist on it. For 40 feet the left-hand rail had to be carried in one span clear of the floor. The roof also had to be carried in



LOCATING A CRANE UNDER DIFFICULTIES.

the same manner. This we did with a 24-inch I-beam at *B*. The crane rail was carried on the lower part of this beam, as shown in Fig. 2. We figured that whenever we had over 6 tons on the left-hand end of the bridge near the center of this 40-foot span that we ought to put a temporary brace up to hold it, a piece of 4x4 joist being enough.

We placed the 9-inch I-beams for the cross bridge with their tops level with the top of the rails on which the bridge travels. This enabled us to keep everything as high as possible. With the bridge level it made a rather peculiar looking crane, with one end hanging 16 inches lower under the wheels than the other, but it has served the purpose well for a number of years.

When using a 2-ton triplex hoist we hang it from the top shaft of the trolley at *c* and can hoist clear up between the bridge beams. For heavier loads up to 6 tons we use the rigging indicated in Fig. 1. This is practically the same as used by Yale & Towne except that the links or side plates that hold the sheaves are made long enough so that we can thread the chain that comes with the hoist around the sheaves without taking off the hook. This enables us to change from a 2-ton hoist to a 6-ton hoist in a very few minutes. As it is only when shipping large machines that we need over a 2-ton hoist, the saving of time in using it direct is very considerable.

No mechanism for traversing the load in either direction was made or ever needed. All wheels have roller bearings, everything is kept leveled up so that an easy push on the load itself will carry it wherever wanted. To keep the bridge square with the track we use the device at Fig. 3. The wheels at one end of the bridge are grooved so that the bottom of the groove is as close a fit as practicable to the head of the rail. The sides of the groove are sloping. If the bridge gets out of square it will tend to ride up on the sides of the groove and then to fall down into its proper place. This would not work well with a much heavier crane than the one designed—in fact, I had some hesitation about using it in this case, but it has proved to be all sufficient. We took care that all the wheels were of the same size and the rails were lined up carefully so that conditions were in our favor. No considerable wear of the sides of the groove has so far appeared. The wheels at the other end have their flanges far enough apart so that there is no danger of their touching the rail unless the rails should spread. E. H. FISH.

Strains Caused by Hardening.

At page 162 is a letter about hardening tool steel. I would like to tell some of my practical experience in that line.

When steel is heated very quickly it is apt to check when suddenly cooled in hardening and will show small lines, as if

it had been burnt or overheated. I have always noticed that steel given sufficient time to heat will be more even, and when put in the bath will not so irregularly change its shape.

A few years ago I had two large milling cutters to make, with 7/8-inch holes. I said to the foreman, "Don't you think these blanks should be annealed?" He said, "No, they will come out all right." I explained to him why I thought they ought to be annealed, but it was of no avail. When the cutters were hardened the holes were too large, and he thought I had used the wrong reamer.

When working the steel I noticed in it dark spots that were a little harder than the rest of it, and when you find that you can rest assured there will be a change when the piece is hardened; therefore the blanks should have been annealed before finishing. It would save extra expense and trouble a great many times if steel was annealed a second time, to relieve the strain that often appears in long bars.

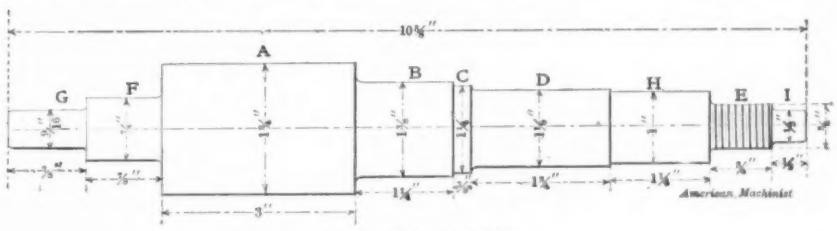
What I think is the cause of this non-uniformity after hardening is that these hard spots relax more than the soft portion, which has expanded in the working before it is cut for tools. When you have an elastic band on the finger it stops the blood and you will feel a constant strain until the band is released. So, I think, steel is under a great pressure until the strain caused by the hardening is relieved by drawing.

In reference to the die that came out larger on one end than the other, I would say that sometimes this is caused by using a mandrel with more taper than the standard.

JOHN KNOUSS.

A Turret Lathe Job.

Having from time to time seen descriptions of rapid turret lathe work in the AMERICAN MACHINIST, I herewith submit a sketch of one which will, I think, do credit to the makers of the "flat turret."



A TURRET LATHE JOB.

It is a spindle which we manufacture in quantities and is used on a well-known automobile. The material is machinery steel bars 1⅞ inches diameter. The black bar is chucked and the first turner runs up and sizes the bar to the dimension *A*, the second turner then runs up and sizes the remaining portion to *B*, the third turner sizes *C*, the fourth turner sizes *D*, the fifth turner sizes *E*, and the sixth tool cuts the piece off to exact length. It is then chucked on *A* and sized to *F* and *G*, then rechucked on *A* and finished to size on *H* and *I* and threaded 5/8 inch U. S. standard on *E* with the die head, which completes the piece. All the diameters have to pass limit gages, and have to be to size within .0015 inch. Considering the quality of the work and the fact that the bars have to be chucked three times, we think the time taken—32 minutes each—a remarkably good performance.

AUTOMOBILE.

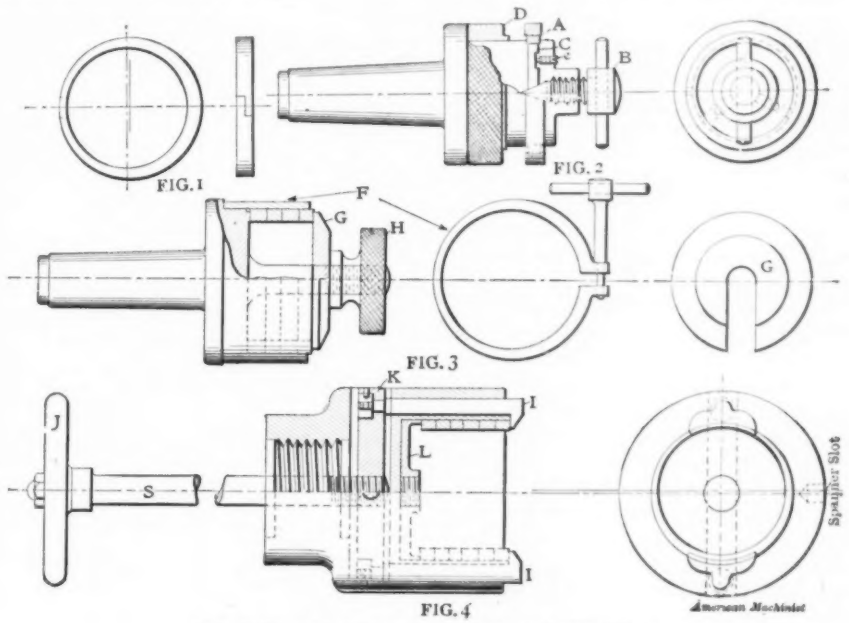
Birmingham, England.

Fixtures for Machining Packing Rings.

The enclosed sketches show fixtures designed for machining 3-inch packing rings on a 12-inch Hendey-Norton lathe. The castings from which these rings are made are cylindrical shells, 3⅛ inches in diameter by 5 inches long, with three equidistant, outwardly extending lugs on one end. These shells are held in a three-jaw universal chuck while the lugs are faced, after which a hole is drilled and tapped in each lug. The shell is then clamped to the lathe face-plate with three cap screws.

Fig. 1 is the finished ring, which is made thickest at the point opposite the split, thereby preventing leakage and equalizing the springing tendency of the ring. After the shells are rough bored and turned the rings are cut off with a gang parting tool, allowing .003 inch on each side for finish.

The ring is then placed on Fig. 2. The shank of this fixture is fitted to the hole in the lathe spindle. In the adjustment of the packing ring to be located true and in the proper position, it is placed a little forward on the split steel ring *A*, which is of a less width than the finished ring. The screw *B*, with a 60-degree point, is slightly tightened, causing the three hardened-steel pins *C*, in which the point of *B* seats, to be forced outward and expand the split ring *A*, thereby clamping the packing ring. The hardened knurled sleeve *D* is then tapped against the packing ring, the small hub on *D* coming in contact with *A* locates the packing ring true and central with *A*. The screw *B* is then tightened and the sides of the packing ring faced with a double tool. A flat on the pins *C*—in connection with the gib screws *c*—prevent them from turning out of position. Fig. 3 also fits the lathe spindle. The packing rings, after being split as in Fig. 1, are clamped in the round clamp *F* and placed on Fig. 3. The split washer *G* is put in place, and the nurled nut *H* is tightened. The clamp *F* is removed and the rings are turned to the size of the cylinder and polished.



THE RING AND THE FIXTURE FOR MACHINING IT.

Fig. 4 screws on the lathe spindle and is tightened and released with a spanner wrench. The hole in this fixture is bored the size of the cylinder and out of center, so as to give the desired eccentricity to the packing rings. The elongated slot thru the main body of Fig. 4 allows for clamping the packing rings with hook bolts *I* when tightening on the hand-wheel *J* on the drawing-in rod *S*, which extends thru the hub of wheel coming in contact with the end of the lathe spindle. In removing the rings, bolts *I* are turned halfway around, being a loose fit in the square bar *K*. A small hole is drilled thru each end of *K* and a pin extended thru into the round nut to prevent it from turning while assembling the fixture or clamping the nut against the threaded shoulder of *I*. *L* is

a parallel washer—clearance being allowed for the tool—and is withdrawn along with the rings, with a hook bolt freeing the fixture from chips, etc. G. V. HUBER.

A Nut Arbor — Necessary Appurtenances for Fastening Work.

The nut arbor suggested by Geo. W. Armstrong at page 155 is lacking in one respect—speed. On a quantity job it is very slow work taking the arbor off the centers and replacing it after every cut. If the lathe centers are standard, as they should be, why not make the carrier end longer, turn a taper to fit the spindle, with a short portion at the end, which make straight, and flatten one side for the carrier set-screws? Then for facing a nut or two use it on the centers, but with a half dozen or more nuts to finish, place the arbor in the spindle and the time can be reduced considerably. For these arbors I would suggest tough machinery steel with the ends case-hardened.

J. W., in the same issue, page 159, does not over-estimate the value of adequate fixtures for the planer, boring mill, drill press and other machine tools. There is all the difference in the world between substantial blocking, clamps, etc., and scrap make-shifts, both in point of time and security against damaged or spoiled work. Standardization in machine tools cannot be better applied and with more certain results than in the T-slots.

It will generally be found that the drill presses, planers, lathes or other tools requiring clamping bolts, have T-slots of different sizes. This very fact might be properly claimed as a good reason in favor of "home-made" machine tools, for when built in your own shop all fixtures can be made interchangeable.

It has occurred to me many times, upon finding in use the usual assortment of clamps, made from flat steel with a hole drilled for the bolt, how much more adjustable and convenient are those made from square steel, simply heated and formed into long U-clamps, using different sizes of steel for different length clamps—5/8 square for 4-inch, 3/4 up to 6-inch, 7/8 or 1 inch for 8- or 10-inch, etc. For point clamps drill thru the round of the "U" and braze in a tool steel or other tough steel point.

As a means for making one set of standard machine bolts fit several different sized T-slots, a piece of strap iron or steel bent so as to fit around the head and prevent turning in the slot, is a useful and inexpensive convenience. It takes but a few minutes to make up a dozen or two, and if a few are lost or mislaid, the loss is insignificant.

A number of threaded couplings or long nuts made from pieces of bar iron, steel, or even gray iron, left round or otherwise, and tapped to the size of bolts used for clamping, come in just right sometimes to make up an odd-size bolt by using one bolt in the T-slot with coupling screwed on end, another screwed into the upper end of the coupling combining to form a bolt with adjustment or nut in some intermediate part of the length instead of at the end.

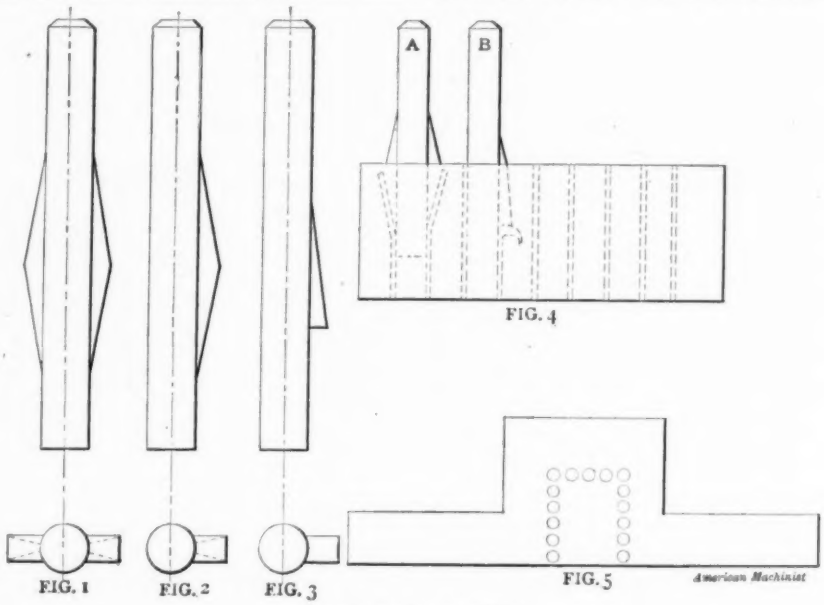
E. J. BOWERS.

A New Kind of Drift.

Fig. 1 shows a new tool to cut the web between the holes that are drilled in a crankshaft forging to remove the stock at crank pin, Fig. 5. It cuts better than the old style, as the wedge-shaped edge pushes sideways and shears the web out, thereby having less resistance from the chip, as at *A*, Fig. 4.

The old-style tool at *B*, Fig. 4, presses straight down on the web, pushing the chip in such a way that it gets thicker as it goes down, thus crowding the tool.

The new style, which has double sides, can do twice as much work with the same amount of hammering as that shown in Fig. 3. A pneumatic hammer is the best to use, where it can be had. The tool should be made of good tool steel with the cutting edge tempered. M. P.



A NEW KIND OF DRIFT.

Drafting for Toolroom Work.

Altho tool draftsmen have long been employed by some concerns, it has been but recently that this branch of drafting has become specialized. There is a demand for good tool men, and those who *are* good have no trouble in getting employment. To become a first-class tool draftsman one must have some shop and toolroom experience, combined with a fair knowledge of mathematics. Some of the best tool men are ex-toolmakers who have taken up drafting and have been inclined to be studious.

One who is designing tools every day can easily tell by a man's work whether he has been a toolmaker or not. There are little points of error, and not a few large ones, which show up and which would cause plenty of trouble if they should get out. For instance, the holes for the stripper screws might be laid out so near the edge of a die as to crack in hardening. A bending die might have a female punch where it should be male. Again, a jig might be made left-handed.

In designing tools I have found that employers do not want anything fancy about jigs and fixtures, but they do want them to work. I have found also that you cannot adhere to the usual rules of drafting, for the reason that it takes too much time. One must acquire conventional methods of drafting for tool work. In showing screw threads, show threads only on the screws and not in the holes—that is, do not continue the thread beyond the visible screws. I use the B. & S. method of screw threads, but show no slant. On nurled headed thumb-screws, show the nurl by crossed section lines and make no attempt to shade. In fact, I don't shade anything. Never draw anything at an angle where it makes a lot of irregular projections; it looks very pretty, but is a waste of valuable time.

I think the best way to get up a tool drawing is to use a yellow paper like K. & E. duplex, and, when it is approved, shellac it. It is then ready for the shop. Tracing is all right, but as a tool is seldom, if ever, duplicated, I do not see where there is any advantage. A shellacked drawing will last for years and can be easily cleaned if it gets dirty in the shop.

A quick and easy way to design small tools is to trace in the piece to be machined on a piece of tracing paper and construct the tool around it. When you are satisfied with it, begin your drawing. It is very poor fooling to begin to draw without first knowing what you are going

to do. I always draw the piece to be machined in red ink so that it will not erase when I am making changes.

S. E. BOYNTON.

Blueprints From Pencilled Drawings.

Some time ago I noticed an article about making blueprints for the shop from pencil sketches. It did not seem to me that it would be very practical, but upon trying it I found it to give very good results indeed; so good that we are making all of our drawings in this way at present.

We do a great deal of special and experimental work where it is very often desirable to get a drawing into the shop as soon as possible and we usually could not wait to get it traced and make a blueprint, but would shellac the pencil drawing and send it into the shop. This we did not find satisfactory, but we now make our drawing on a thin paper and can make a blueprint and have it in the shop within five minutes from the time the drawing is completed.

The most satisfactory paper I have found for this work is a thin, unprepared blueprint paper which seems to have more strength and gives a clearer, better print than any bond paper I have been able to secure. Using rapid blueprint paper, a pencil tracing and good sunlight, it is necessary to make an exposure of only one minute.

I have tried the different grades of pencils and find that the 2-H is most satisfactory for this work. I find this method to be such a great labor saver and so entirely satisfactory in every way that I am surprised that it has not come into general use.

W. P. HUNT.

[Regarding what Mr. Hunt says about having at first thought that the method mentioned by a previous correspondent was impracticable, there is perhaps a word to say, and that may well take the form of a word of caution regarding the habit of making up one's mind that a thing which is outside one's own experience, and therefore strange, is impracticable. We are convinced that too many of our readers see articles in the paper which they conclude are impracticable but which in reality are entirely practicable, and will work well if tried. As a general thing, the methods and processes described by contributors to the AMERICAN MACHINIST have been successfully used by the men who write about them, or by men associated with them, and the presumption therefore is strong that the described method or process or device is practicable and will work. It does not of course always follow that it is the best possible method, and our articles are not published with the understanding that we consider them to describe the best possible methods. They only describe a way in which certain work has been done by a practical man; but for this reason we think they are generally entitled to an examination and careful consideration if one is interested at all. It is easy to say "impracticable," "it won't work," but sometimes it does work and has worked.—Ed.]

Ball Lathe Centers.

Taper-turning attachments are generally short, therefore for long work where the tailstock must be set over, ball centers as at Fig. 1, while not new, are very useful. They do not cut the work as at *A*, Fig. 2, thus spoiling both the work and the center. The best way to use these centers is to rough the work out as near as possible to size and then put the ball centers in and set the tailstock over, leaving only a light cut to be turned off; then the centers in the work will be left in good condition.

FIG 1

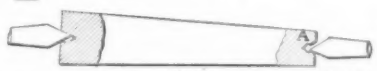


FIG 2 *American Machinist*

BALL CENTERS FOR TAPER TURNING.

Fig. 2 shows the position of the ordinary center in the work when the tailstock is set over. Both centers should be hardened.

MORTIMER PARKER.

A Mean Trick.

What appeared to us in the shop as a very mean trick was played on us by the foundry which supplied our castings. It was a patched bed for a 20"x20' lathe. The order was in a rush and when the casting came in it was put right on the planer, finished there and rushed right along until on the car at the shipping door, being sent a thousand miles or more. Nobody in fitting the machine up had found anything wrong, but a letter was received by the firm stating that on taking the lathe from the car it was found the bed was cracked and had been patched. The letter gave the firm a terrible roasting for trying to palm off patched-up work, and said it was a mean trick putting such stuff on them, and to send and get the lathe. Of course the firm were much surprised and very much annoyed about the matter. They wrote the customer for a description of the patch and crack. It was a neat job well plastered over and went thru the shop without being noticed, but when shaken up in the freight car the filling in the crack worked out and left the fraud exposed.

The foundry owner and boss claimed to know nothing about the matter, but he lied, and by a little detective work a discharged molder was found who had seen the job patched in the foundry and said the boss knew all about it. The affair was fixed up between the firm and the foundry some way, by the foundry standing the loss of the lathe builders, but just how I never learned. If the foundry stood for all the real loss, it must have been a good-sized bill, by my way of figuring it.

It would be impossible to know how much damage a trick like this might cost a firm if some rival concern wished to use it against them, especially if the people buying were not fully convinced the lathe builder had not been partly to blame.

YOURITSKY.

A Word of Appreciation for Those Who Send Catalogs.

At page 1617, Vol. 27, a contributor writes of his disappointments in not receiving the catalogs he has sent for, and wants to know if his experience is an exception or the fault of the advertiser.

From my own experience I should say that his case is certainly an exception. Of the numberless catalogs I have sent for I have never been refused one. When I was a little fellow, working on one of the jobs in the shop, running errands and making myself useful in various ways, naturally I wanted to get all the information about the machinery I could, and lacking the means to buy technical books, I used to read old catalogs picked up around the shop.

I remember what a treasure my first Brown & Sharpe catalog was. One of the toolmakers had thrown it away under his lathe, and, picking it up, I asked him if he had really thrown it away. I could hardly believe him when he said yes, and I went straight away and hid it in a drawer where I kept sundry treasures. Whenever I had a spare moment I was reading it and wondering if I would ever be capable of running the machines shown in it.

One day the boss caught me reading it and asked me what it was. I told him, and he asked me why I didn't take the AMERICAN MACHINIST, and I told him I supposed it cost too much. When he told me that it was only 8 cents a week I made up my mind to begin taking it at once. When I had got my first copy and was looking thru the advertisements, I saw at the end of nearly every one, "Send for catalog." That decided me at once, and I began accumulating catalogs. I could hardly have been better treated if I had been in the market for two or three thousand dollars' worth of machinery. Some of them even now send me their new editions as they publish them, without my asking for them. The catalogs were a great help to me in those days, as the city library contained no books on machine tools and machine shop practise of a later date than 1870, and it was like reading ancient history.

I would advise any of the younger machinists who are not able to buy technical books, to try this scheme. There is a great deal of valuable information to be gained from a careful perusal of catalogs.

When I was told that I would soon be advanced to another machine, I would

read up all I could find about that machine in my AMERICAN MACHINIST and then send off for catalogs describing the machine, and in that way I was posted on the machine before I went on it. In those days there were very few articles written about grinding, so when I went on to a grinder I had to depend on catalogs alone for information, as the foreman I worked for then was a great hand for letting a fellow see what he could do alone, and if he got along all right without needing information, he never attempted to give any. When I sent for the first grinder catalog, the firm kindly sent me their treatise on grinding, which they had just issued, and sent it without charge, too. I kept it right there in the shop, absorbing all the grinding knowledge I could get from it. After I had been grinding a few days the foreman came around with a reamer and asked me if I thought I could grind it. I told him I guessed I could, so he left it there and I started in on it and came out all right. I took my treatise on grinding and propped it up on the bench, opened at the page that told about grinding reamers, and had no trouble.

I would advise anyone sending for catalogs to acknowledge receipt of same. I never did then, but now wish I had, and I always do now; so any advertiser in the AMERICAN MACHINIST who reads this little acknowledgement can accept my sincere thanks, for there are very few who advertise in the AMERICAN MACHINIST that I haven't received a catalog from some time or other. PAUL WESLEY.

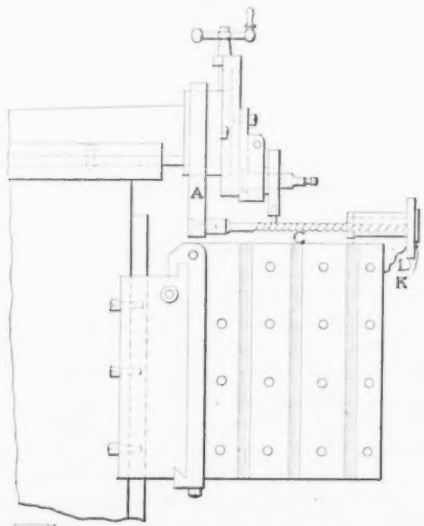


FIG. 1 Side View

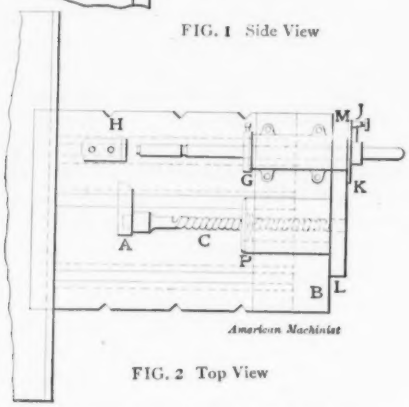


FIG. 2 Top View

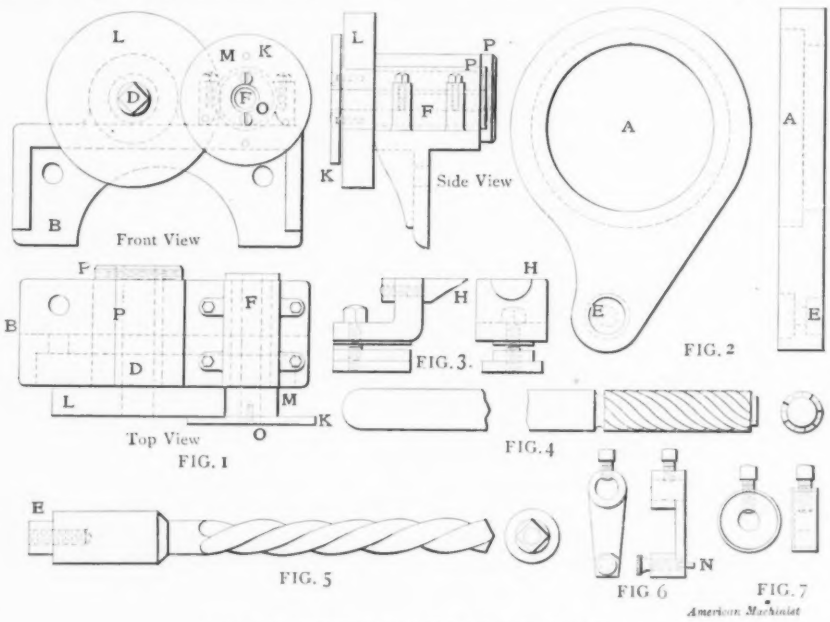
CUTTING SPIRALS ON THE SHAPER.

Cutting Spirals on the Shaper.

At page 161 Dixie illustrates the cutting of internal and external spirals on the planer. This he does by means of two photographs which show the various parts all assembled so clearly that any machinist could understand the method by which the spirals are cut. In the shop where I am working, spirals are cut on the shaper with a fixture quite different from Dixie's. The spirals, six in number, are cut on bars of 5/8-inch cold-rolled steel; the ends are afterward bent to form handles for small presses. As I have no camera, and am not a skilled draftsman, I cannot draw the jig in the best manner. However, I show the various parts which I think make it clear. In Fig. 1, *B* is a casting which is bolted on the front of the shaper table. Fig. 2 is bored out at *A* to fit over the shaper head. In setting the jig, the graduated half of the shaper head is removed, then Fig. 2 is slipped over the other part, and the graduated portion of the shaper head is replaced. The spiral, Fig. 5, is placed in the bearing *D*, Fig. 1, and then *B*, Fig. 1, is bolted to the table. Fig. 2 is now swung around until the hole *E* comes in line with shoulder *E* on Fig. 5. The two are then held together by a large filister head screw. Then the head is tightened, which holds Fig. 2 in place. One of the handles, Fig. 4, on which the threads are to be cut, is now passed thru the hole *F*, Fig. 1, and the collar Fig. 7 is passed over it and the handle is passed on until it rests on center *H*, Fig. 3, which is set at the required distance. The collar, Fig. 7, is then tightened, which prevents the handle from slipping back. Then the index, Fig. 6, is placed on the projecting outer end of Fig. 4 and is located in one of the six holes in index plate *K*, Fig. 1, and is held by the screw. Index plate *K* is located on the shoulder *O* of the gear *M* and is held by flat-headed screws. *L* and *M* are two gears on the ratio of 26 to 74.

It can be seen from the description given that as Fig. 2 is held on the head of the shaper, and is rigidly connected with the spiral Fig. 5, when the shaper is started in motion, Fig. 5 in passing thru the bearing *D*, Fig. 1, causes it to rotate. Now, as the gear *L* is meshed with the gear *M* it causes it to rotate according to the ratio of the gearing. The handles are made of 5/8-inch stock and are turned down to 1/2 inch at the end, so when the boy is cutting a thread, as soon as he reaches the shoulder he draws up the tool and stops the shaper; then grasping the index, Fig. 6, by the nurled nut, and drawing out the locating stud *N* he moves it around to the next hole, thereby setting for the next thread. In this manner the six spiral threads are cut. When done he loosens the set-screw on the collar, Fig. 7, draws out the handle, removes the index, Fig. 6, and sets another handle as described. The gear *L* is solid with the journal *D* and is held by the collar *P*, which is screwed on, and held by a brass tipped screw. The gear *M* is also solid with the journal.

In the two views of the shaper, Fig. 8 shows a side view, Fig. 9 a top view minus the head. Neither of the views are accurate in regards to detail, but I think enough is shown to make the method of working clear. For lubricating the cutting tool a funnel is placed in the tool-post and a plug is placed in the spout; it is adjusted so that the oil comes down in drops, thus keeping a fine stream continually trickling on the point. A tool-holder is used with an inserted cutter; this makes it easy to replace a cutter when worn, for a new



RIGS FOR CUTTING SPIRALS ON THE SHAPER.

one can be inserted without removing the holder. An experienced man sets up the fixture, then a boy is put to work on it, and, as Reddy terms it, "it's a regular graft," for it means an easy sitting job for the boy that gets it. PEDRO RE.

An Unusual Use of a Drill Press.

In this day of modern machine tools, this temporary use of a drill press may be interesting. A drill press is very often used as a boring machine, but I have never before seen one used on as big work as this, and then only as the feed.

The beds which we had to bore out were 2 feet deep by 6 feet wide by 12 feet 6 inches long, weighing about 13,000 pounds, and had four bearings in their length, one 20 inches long and the other three 15 inches long, all 10¾ inches in diameter. The bearings were cylindrical, and had just one half their diameter in the bed. The bar was 8 inches in diameter by 14 feet long, and had four tools, set in and adjustable by set-screws. The tools were spaced one-quarter revolution apart, so that two were always cutting, which saved the jerk on the drive when a tool is suddenly released from its chip, and were spaced at the proper intervals along the bar, so that all four bearings were being bored out at once.

It was very important that just one half of the shaft should be in the bed, so two housings or supports were made, one shown in Fig. 1, and in detail in Fig. 2, at *A*. The ⅞-inch screws *B* in the lugs kept the housing from moving sidewise, and the ¾-inch screws *C* on each end counteracted any tendency to buckle by the hook bolts which held the housing to the bed.

So much of this rig was the permanent fixture, and was found after one and one-half years to be all that could be asked for, boring the bearings true and in line, and easily handled.

The machine which was ordered to drive this bar was still ninety days away when the bed castings began to arrive. To pile them up and wait was out of the question, so we looked the shop over for a drive and feed for the bar. A 5 horse-power, variable-speed motor, 900 maximum revolutions per minute, taken from a radial drill press, furnished the power, and drove thru a train of gearing shown in Figs. 1 and 4, to a 108-T, 4-P gear mounted on the bar. This last gear is free to move endwise on the bar, so the bar can be fed thru it, being driven by two double-headed keys, 1½x1½ inches.

For the feed to the bar we took the sliding head from the radial drill press and mounted it horizontally on the drill table, with the end of the spindle fastened to the end of the bar. This drill spindle has nothing to do with the drive, but is driven by the bar, and by putting on a pretty coarse feed gave the motor about all it wanted to do. The chip varied from ¼ to about ¾ inch deep, and the feed about .060 inch per turn. Under these conditions the drill spindle was not working hard, as it was only doing the feeding.

The hole being only half a hole, was difficult to measure accurately, so for a finishing tool a 90-degree segment of a ring fitting the bar, and about 6 inches

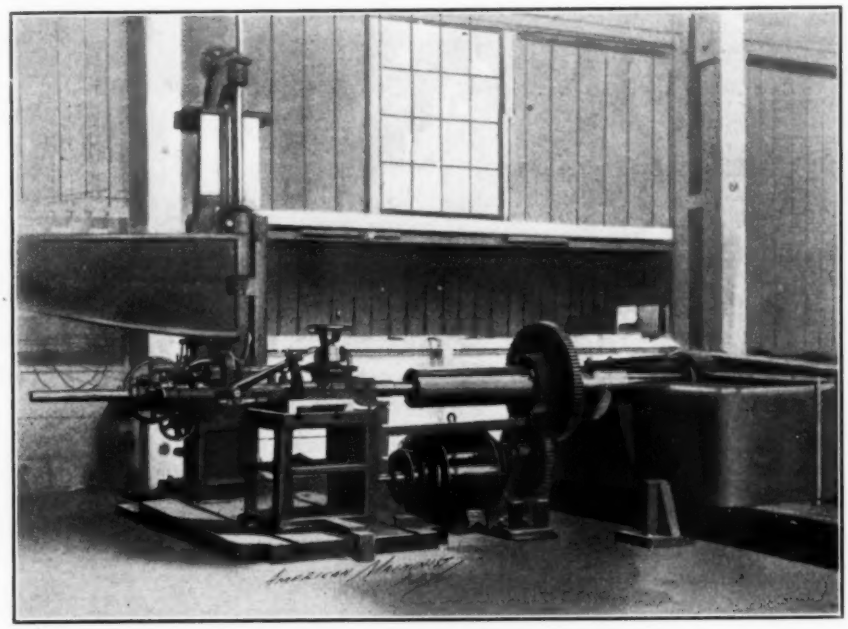


FIG. 1. BORING HEAVY BEDS WITH DRILL PRESS AS FEED.

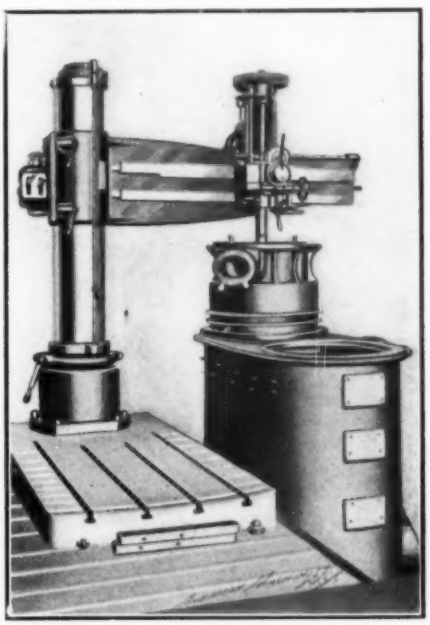


FIG. 5. GRINDING IN A CYLINDER.

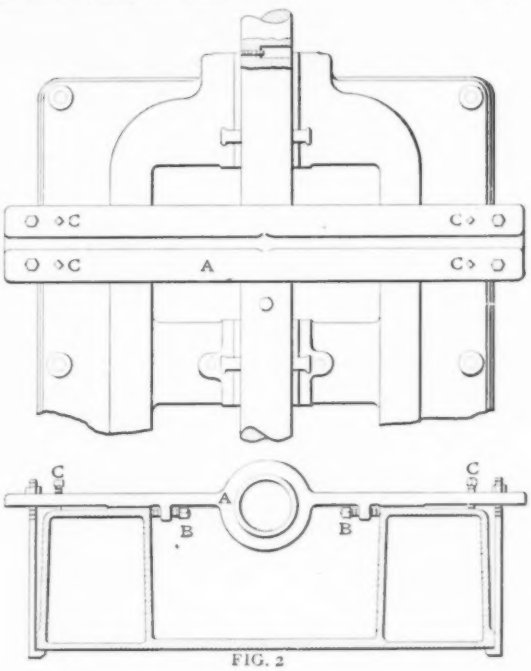


FIG. 2

FIG. 3

FIG. 4

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DETAILS OF THE FIXTURES.

long, is used (see Fig. 3). On the inside is a tit fitting the cutter holes in the bar, and on the outside is set in a dove-tailed cutter, tapering lengthwise. This is ground accurately to size in the toolroom and used for a finishing reamer. As it is less than half a circle, it is very readily seen how it is used on one bearing and then moved to the next tool hole, and so on, without disturbing the bar or housings, and insures a true, straight job.

Fig. 5 shows a cylinder being ground into place. The crank case stands in a pit in the floor to bring it to a convenient hight. The cylinder is driven by two studs screwed into its top flange, and a ¾-inch square bar thru the drift pin hole in the spindle. This bar will bend before anything can happen to the drill press, and is the safety device in this case. The cylinder weighed in the rough 2,075 pounds. There are two grinding strips, ⅝ and ⅜ inch wide, which can be plainly seen ground in on the front hole. The fit of the cylinder in the crank case is about 35 inches diameter. C. WATERMAN.

Bending Eyes of Various Shapes.

The drawing shows an arrangement of power press dies or formers for bending small rods or wires to shapes as shown in Fig. 4. The shape actually formed as here shown is the "D" shape No. 1. Altho the movement of the press plunger is vertical as usual, the bending is done horizontally. Fig. 1 is a front elevation and Fig. 2 a side elevation of the entire arrangement, and Fig. 3 is a plan of the lower part. In the base *A* there is a dovetail cross-slot in which is the sliding block *B*, the top of which is flush with or only slightly above the surface of *A*. The sliding block *B* is operated by finger *C* which moves with the plunger. The lower end of this finger, which is narrow and parallel, is long enough to always reach down into the base which has a slot which fits and guides it. This finger passes thru the slot *E* in the sliding block *B* and in its descent the oblique face *F* strikes the end of slot *E* and causes it to advance. On the side of finger *C* is an oblique projecting strip *a* which works in a notch *b* and acts to draw the sliding block *B* back to its normal position when the finger rises on the return stroke of the plunger. There are two other sliding blocks *G* and *H* moving at right angles to block *B* and operated by fingers *I* and *J*. It is only to be noticed that the oblique edges *K* and *L* of these fingers are higher and therefore in the descent of the plunger move the blocks *G* and *H* later than the movement of block *B*. On the face of block *B* is fastened the former *M* and on the faces of *G* and *H* are formers *N* and *O*.

The wire to be bent, ¼-inch iron, is cut to length and heated, and a piece is centrally placed in front of former *M*, Fig. 3, and then when the ram comes down the inclined edge on finger *C* draws *B* forward and the former *M* working into the semicircular opening in *P* forms the piece into a "U," and then formers *N* and *O* advance and bend the ends over, completing the "D" to be formed.

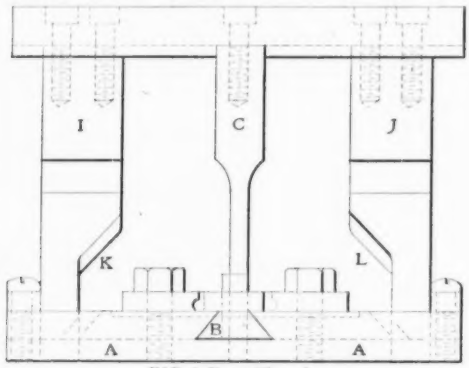

FIG. 1 Front Elevation

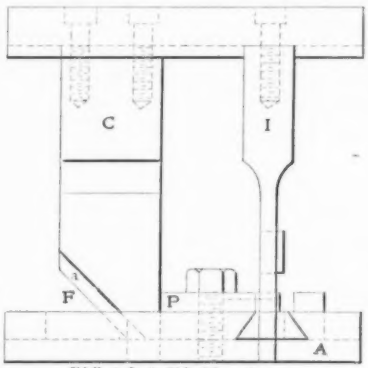

FIG. 2 Left-Side Elevation

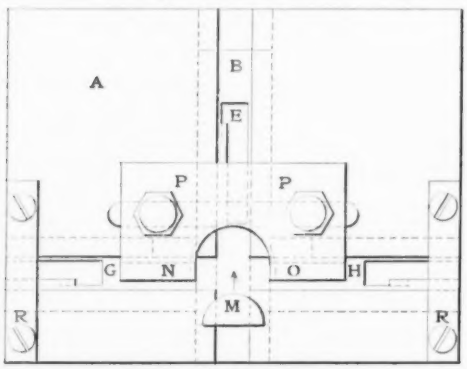

FIG. 3

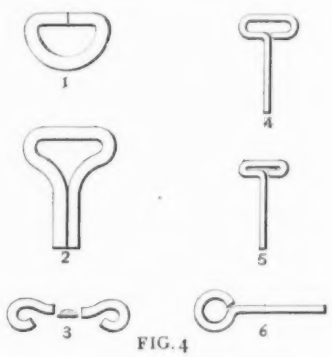

FIG. 4

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BENDING EYES OF VARIOUS SHAPES.

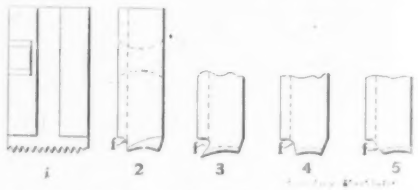
Nos. 4, 5 and 6, Fig. 4, are made of No. 9 soft, straightened brass wire fed to the die from the right, there being a cut-off attached. The forming mandrel for No. 5 is caused to slip down out of the way at the end of its stroke, permitting the loop to close tight. For making No. 3 the forming mandrel is stationary and the forming block is caused to move on account of the mandrel in this case being somewhat weak.

R and *R*, Fig. 3, are steel strips fastened by screws on to bottom plate *A* and acting as backs for fingers *I* and *J*, *P* acting as a back for *C*. The piece *P* has a tongue on the bottom fitting into a slot cut in the bottom plate and fastened on with two cap-screws. Having designed this device before I knew just what press it was to go on, I did not show lugs on the bottom plate to fasten it to the bolster, neither have I a stem shown on the top plate.

Moline, Ill. A. D. K.

A Point in Cutting Fine Sharp V-Threads on Lignum-Vitae.

Not so very long ago I had the job of making a new set of lands for a self-opening threading die. The die was to be used on lignum-vitæ wood, the thread was



SHAPE OF DIE TEETH FOR LIGNUM-VITAE.

to be a 60-degree, sharp thread, ¾ inch diameter by twenty-eight per inch, and the die was to be put to work in a turret lathe. I made the lands in the most convenient way possible; there were three to a set, and when finished they looked like Figs. 1 and 2 in the accompanying sketch, with the exception of the face of the threads, which received several grindings before they would cut a good thread. The face of the threads, as shown at Figs. 2, 3, 4 and 5, shows some of the steps of the grinding process, which finally resulted as shown at Fig. 5, and which then cut a satisfactory thread.

Now for the point. Why did not the die as ground at Fig. 3 cut a good thread, or at least any thread at all? I believe it was because there was too much lip for the nature of the wood, and instead of cutting a thread, the die simply lifted the grains of wood right off and made the work look as if a chasing tool had been run over it. I had thought that, when cutting a thread on wood, the best results could be obtained by grinding a good lip on the face of the teeth, but I soon realized I was mistaken. So I then ground them as shown at Fig. 2, which is the proper way for most general use; but even then they only cut so as to show the faintest sign of a thread, so I ground and tried them two or three more times, until I had them as shown at Fig. 4. At that they would cut about half a thread, so I kept

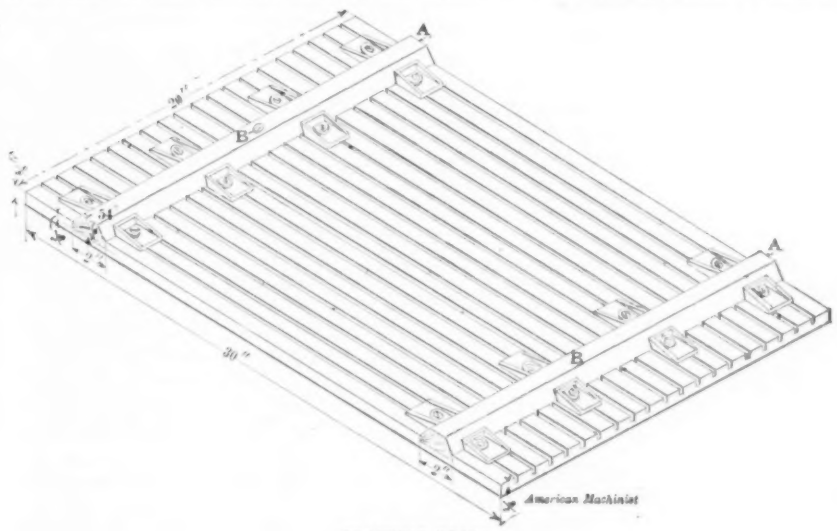
on grinding a little at a time and trying, until I had them as shown at Fig. 5, and at that they cut a first-rate thread. So I conclude that the cutting of a good thread is due to the fact that the grinding, as shown at Fig. 5, being the opposite to that as shown at Fig. 3 (which had a tendency to tear the grains of the wood apart), exerted instead just the opposite tendency, which would be, to press the grains together, thereby assisting the cohesiveness of the wood, with the good results mentioned.

The points of the teeth at Fig. 5 are very slightly rounded. BOB.

A Drawing Board.

For the readers of the AMERICAN MACHINIST who have experienced trouble with the drawing-board in general use, I herewith submit a sketch and description of the style of board used in our engineering department for the past five years, which board has given excellent results, and proves as true on the face to-day as when first made.

The board of which I send sketch is 20x30 inches, whereas our boards are 22x33 inches, made from two pieces of well-seasoned pattern stock, 5/8x11¼x34 inches, glued together to give the desired width of 22 inches, and allowing some for truing up. We first get the sides parallel, then on the back put in saw kerfs (with the circular saw) ¼ inch deep, 1-inch centers. Next we let in battens *A* one-quarter of an inch. These battens are made of 1x2-inch pine beveled on the sides to 54 degrees to conform to the aluminum clamps, of which sixteen are used to each board, as shown. These battens are fastened to the board merely by the wooden dowel pins *B* which are glued in. The clamps are now screwed on, but not too tight, thereby allowing the board to shrink or swell, as the case may be. Boards made from this design have expanded a full sixteenth of an inch on each side of the dowel pins.

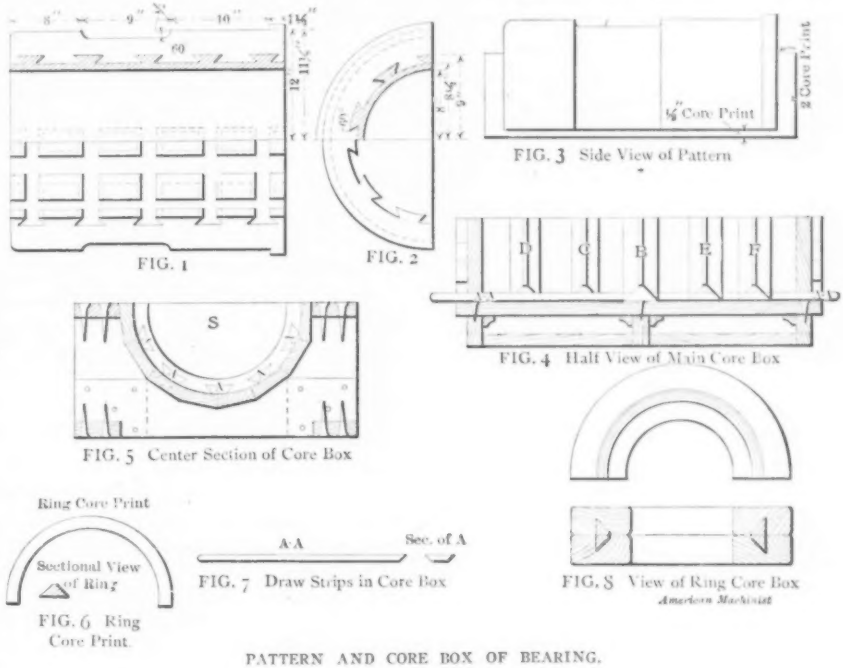


DRAWING BOARD.

Previous to adopting this method of construction we tried about every known method without the desired results, but after five years' trial of this board I can freely recommend it as being nearest to the ideal board. A. D. FINLEY.

Pattern and Core Box for a Bearing.

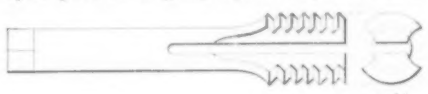
Figs. 1 and 2 are drawings of a bearing having square dovetail blocks for holding in babbitt. Fig. 3 is a drawing of the pattern, and Fig. 4 is a half section of the main core box, showing core-print rings, also the draw pieces marked *A A*, which are pulled out before the core box is taken off the core. These pieces abut against center ring *B* and run under the rings *C D E F*. These rings also hold the draw pieces in their proper places. After the core box is removed, the ring cores—made in the core box at Fig. 8—are placed in the impression of the ring core prints *B, C, D, E* and *F*. By this method the corners of the dovetailed block come out sharp in the casting, and it makes a simple job for the molder. JOHN F. PITZ.



PATTERN AND CORE BOX OF BEARING.

Tap for Cleaning Threaded Holes in Dies.

The sketch shows a little "kink" for diemakers. It is a tap to clean out tapped holes in dies after hardening. A necessary precaution when hardening dies, to prevent cracking, is to plug all dowel and threaded holes with asbestos or clay. After hardening I always found it a tedious job to clean these threaded holes properly so that the screws would enter without tearing the threads and sticking in the holes. Entering the regular tap spoils it, on account of the shrinkage of the holes in hardening, consequently wearing off the sharp points of the tap. So I devised a split tap which can adjust itself to the size of the holes to be cleaned. This tap is easily made, as the sketch shows. The split part is slightly spread apart before hardening, to give it outward spring, and only the threaded part is hardened. I have found this a very handy tool.



SPRING TAP FOR CLEANING TAPPED HOLES.

HENRY F. DIESING.

The AMERICAN MACHINIST should be much better known in India than it is at present. It is written mostly by men who are still occupied in the workshop, and who have the art of expressing themselves clearly and soundly on a great variety of subjects.—*Indian Textile Journal*, Bombay, India.

Does one of our esteemed contemporaries really mean that its recent issue is the "Annual Contractors' Number" or the Contractors' Annual Number? There is some difference.

Pattern Making.*

The circular saw, band saw, planing machine, thickness planer and lathe are indispensable tools. The hand trimmer might also be classed with them, for it considerably cheapens the production of patterns, especially of that class which are built up in segments.

PNEUMATIC TOOLS IN THE PATTERN SHOP.

The introduction of pneumatic tools into the pattern shop is among the latest labor-saving devices. Portable drills and chipping hammers are finding a useful place on large work; they have this advantage, that they can be brought right on the work during the different stages of construction when it would be impossible to move the work to the different machines. Chipping hammers fitted with a gouge tool are very handy for removing surplus wood to form curved surfaces in patterns and core boxes, doing the work from four to six times faster than is possible with hand tools. Pneumatic drills also dispense with the patternmaker's brace and bit and perform the work very rapidly and with considerably less labor to the man.

It is in the pattern shop that the engineer and draftsman first see the actual thing which they have designed. Many views and sections may be given but there still remain points which have to be left to the judgment of the patternmaker, such as the development of curves, rounded edges, fillets, etc., all of which go to make the symmetry of the whole. Upon receiving a drawing in the pattern shop, if the work is at all complicated, it is set out full size, but in some cases in sections only that are required for the construction of the pattern and arrangement of cores. Machining allowances are shown. All the laying out is done to a shrink rule, so that any dimension may be taken as the pattern size.

In some works the foreman or leading hand lays out the work. I prefer that each patternmaker should lay out his own work, as by so doing he makes himself familiar with all the details. He is then in a position to discuss the construction of the pattern, method of molding, and arrangement of cores. It is usual for the principal dimensions to be checked by the foreman. The first thing that has to be determined is the best way of molding, and whether it is likely to be a permanent or a temporary pattern. The chief things that govern the molding are the principal machined surfaces; these are placed in the bottom of the mold to insure their being clean and free from defects. If the casting has to be machined all over, or top and bottom, extra machining should be allowed on the top side.

Patterns should in all cases where possible be parted and doweled together on the joint line of the mold, as in the case of a cylinder thru the center line of the circle, so that when the top part of the flask is lifted off, the portion of the pattern covered by it is taken with it. Then the molder can loosen each part separately and see what he is doing when drawing the pattern. It is advisable to lift the pattern from the mold rather than the mold from the pattern.

Loose pieces, such as bosses and facings, altho objectionable, cannot in all cases be avoided. On permanent patterns these should be fixed on by a dovetail. On temporary patterns a screw or a wire pin will do, providing the position of the piece is well scribed around on the body of the pattern. Where several pieces have to be loose near each other, it is as well to leave one large piece of the pattern loose containing them all, providing there is sufficient room in the mold to allow this to be drawn in. Another method of getting over the difficulty of several loose pieces is to put them all together in a core. The objection to this is that in dry-sand work it often leaves a mark on the casting if the core cannot be put in green and dried with the mold.

LARGE PATTERNS.

In constructing large patterns wide pieces of timber should be avoided because of the shrinkage and expansion. Frames made of narrow pieces and half lapped together at the corners can often be used with advantage. These are stronger and retain their shape better than large flat pieces. There is also a considerable saving of lumber by this method. Patterns made of dry lumber will swell when left in the mold for any length of time and shrink when stored away. In boarding up large surfaces, open joints, say ⅛ inch between each joint, should be left. All screw holes should be bored larger than the diameter of the screw to allow free movement when the boards expand or contract.

Where possible the grain of the wood should run in the direction that the pattern is going to be drawn from the mold. As little end grain as possible should be left exposed to the sand. If it cannot be avoided it should be placed so that it is the first portion of the pattern which leaves the mold when it is drawn out. If it is in the bottom of the mold the other way of the grain will shrink and leave the end grain projecting, which will pull a part of the sand up when the pattern is drawn.

In large patterns, such as bed-plates, etc., good provision should be made for rapping and lifting, as such a precaution adds considerably to the life of the pattern. In the joint or side of the pattern by which it is going to be lifted from the mold, stout timbers should be put in to receive rapping plates, connected to the bottom of the pattern by struts or stays. Lifting bolts or straps should go thru the body of the pattern. In cases where bolts are used there should be a plate let in level with the bottom of the pattern and tapped to receive the bolt. Where this system is practised it is usual to have all lifting plates tapped the same size, then one bolt will do service for several patterns. The screwed end of the bolt should be well tapered to give it a lead into the bottom plate. The top end should have an eye at least 2 inches in diameter so that it will receive the crane hooks.

There is a certain amount of suction in drawing a pattern in addition to its weight. Then there is the matter of handling the pattern between the foundry and the pattern loft. If lifting irons can be relied upon, it is better to lift by them than by rope or chain slings, for these generally leave their mark on the pattern. In fact, heavy standard patterns are often more damaged in lifting about than in actual use in the foundry.

The question of draft is often a very debatable subject between the patternmaker and molder. It is seldom the molder complains of there being too much, but excess of draft often means more machining than is necessary. In most cases ⅛ inch to the foot is found to be sufficient. On castings that have not to be machined it is customary to make the given dimensions half way down the pattern, so that the pattern at the top of the mold is over the size and at the bottom under the size.

In complicated patterns sometimes pieces are left so that the molder has to lift a part of the mold away before he can draw the pattern out, or, in other words, make a "drawback." This is an expensive method to the foundry. It can often be avoided by a core print on the pattern and a box made to suit. Altho it incurs extra cost in making the pattern, still it has to be done only once in the pattern shop. Where the core method is used great care must be taken that the piece which forms the part of the core matches the mold; if it is possible, this piece should be worked on the pattern in its place, then taken off and put into the core box. This will insure getting a good joint and only a very slight mark on the casting.

Prints that lift vertically should have more taper than other parts of the pattern. In no case should the taper be less than ⅛ inch to the inch. The size of the core is the size of the print near the pattern. In prints where the core comes thru the top flask for convenience of centering or releasing the core, etc., the size of the print is still kept the right size near the pattern, but tapered larger to give clearance for passing the core down, as shown in Fig. 1. No two prints on a pattern should be the same size, or nearly the same size, or probably the mold will be cored wrong. In prints that mold horizontally the root should have a slight chamfer on it, as shown in Fig. 2, as the edge of the mold breaks down when the core is put in. If this is not done the molder generally takes it off with his trowel each time he makes a mold.

CORES.

Circular core boxes are generally doweled together on the center line for convenience of ramming up and getting the core out of the box. Intricate boxes often

* Abstract of a paper by R. Watson before the Rugby (Eng.) Engineering Society.

have to be made in several parts, and where any doubt exists as to the best way of making it, the coremaker should be consulted as to the handiest way for him to arrange for his core irons and vent passages. Large-sized boxes should be made so that they can be taken to pieces, and the corners rabbeted together to insure that they will be put together right. In boxes for standard work wood screws should not be used, as the constant taking them in and out wears the holes. Bolts should be used with suitable shaped handles or wing nuts.

In large cores allowance has to be made for expansion in drying; 1-16 inch to the foot is found sufficient if the cores are dried at the usual rate. This point (which is not recognized by some patternmakers and molders) is often the cause of considerable delay, due to the time taken in rubbing the cores down to give the required thickness of metal. After the core has been dried, the best test is to try it in the box in which it has been made.

Large cores should where possible be made the same way up as they are to be put into the mold, for convenience of getting at the irons to lift them by when fixing.

Where cored holes have to bore out to exact centers in relation to each other, as in the case of motor cylinders, where two or three boxes are in the same casting, these should be made in one core box tied together by continuous prints at both ends.

Where diaframs, valve facings, etc., on the inside of the casting, have to be put in a particular position in relation to the outside of the casting, a key must be put on the core and its print. This should be put on the joint of the mold, where it can be seen when coring up. It is often found useful to make the print on the pattern smaller than the required size of the core, so as to form a shoulder on the core, as shown in Fig. 2. The core can then be put up to the end of the mold; this will give it a definite position lengthways independent of the ends of the print, from which the molder often finds it convenient to cut the sand away. This shoulder should be made in proportion to the size of the core; it must not be less than ⅜ inch, increasing up to 1½ inches in large cores. In small cores where great accuracy is required and where the metal is very thin the core should be made about 1-32 inch smaller in size than is required, to allow for blacking, and care must be taken that the cores fit their prints, for when rubbing is commenced on the core no two castings will be identical. In this class of work the first casting that is made off a pattern should be cut up to see that all parts are of the required thickness.

Core boxes that are made to suit taper prints should be the exact size at the point where the casting commences, but should be slightly less than the top of the print; this will insure their going in easily and tightening themselves when they are down in their right position. Core boards that are to be used for cores of which large quantities are likely to be required should have a thin sheet of iron on the striking edge, filed to the exact shape of the board; on the top side two strips of iron should be screwed on, giving the exact size of the prints into which the core is to fit, otherwise after a few cores have been made, the board gets worn and often gives considerable trouble to both the molder and the machinist.

LOAM MOLDING.

Large work, such as condensers, flywheels, pipes, etc., are usually swept up in loam, very little patternmaking being required, as loam boards are used to make both the inside and outside, all projections having to be built in the mold. Loam work, as a rule, takes more time in the foundry than when a pattern is used. No doubt it is the correct method to follow

FIG. 1

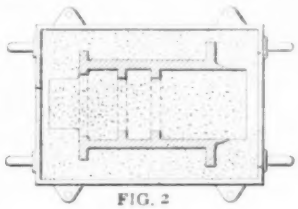


FIG. 2

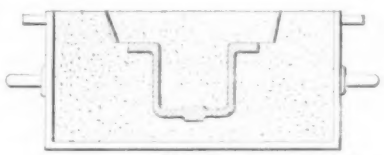


FIG. 3 American Machinist

ILLUSTRATING POINTS IN THE USE OF CORES.

when only two or three castings are required, but when this amount is exceeded the cost of a light skeleton pattern, against the extra time each casting will take to make, should be considered. A case of this kind was given in the *American Foundry Journal* some time ago, where an American company had six sets of large engine castings to make. The first one or two of each of the larger pieces were struck up, and afterward it was decided to make patterns and flasks to suit. In finishing the remainder it was found both cheaper and quicker and the castings were nearer to shape.

Another way of handling work of which only one or two castings are required is to make the outside in cores. This can often be done very economically, for one or two core-box shells with different internal fittings may be made to do duty for all the cores required. This method cuts the patternmaking down to a minimum. In large work, of this class especially, the patternmaker and molder should try to avoid getting into set grooves of working, for the method has yet to be found that is economical and suitable for all work.

Light castings, such as covers, caps, cone pulleys, etc., may be made so that the core takes the place of the top flask and is self-centering, as shown in Fig. 3. This core must be at least 1½ inches thick and 1 inch larger all around than the casting, so that it will bear sufficient weight placed on it to withstand the lift while the mold is being poured. The print should have a large taper; this makes it simpler both for molding and coring up. It is important in this method of work that the core fit its print, and that no blacking is put on that portion of the core which goes into the print. Patterns of this description, if they are circular, should be built up in segments, or framed up if square.

All circular work on standard patterns larger than about 10 inches diameter should be built up in segments. A pattern so made has the advantages of being stronger, does not shrink or expand, and retains its shape better than when cut out of the solid wood. The "trimming machines" now used in most pattern shops have cheapened this class of work. Built-up work often can be made to leave its own core with advantage, and so save the time and material that would otherwise be spent in making a corebox. I do not recommend building up flanges, etc., in less than three courses; in fact, two courses are very little better than when cut out of the solid. In pipes, cylinders, etc., "lagging up" is resorted to when the diameter of the work is large, partly to economize material and to secure a form which will be least affected by the distorting influence of shrinkage and expansion. Lags are usually made from 3 to 5 inches wide, and the number that go to make up a diameter is determined by the size which can be cut most economically out of the width of a plank. In large diameters the rings on which the lags are fixed are built up in segments; this makes a very light but rigid pattern. This method of lagging up is not confined to circular work only, but is used on curves wherever a radial line can be fixed.

There is often a difference of opinion as to the right amount of contraction to allow on special large work, but I think that most people are fairly well agreed that for general castings 1 in 120 is found to give the most reliable results, and most patternmakers' rules are now made to this allowance. Steel and malleable iron of different makers often vary much in the contraction. For large size castings in these metals the safest way is to ask the founder what contraction should be allowed. On small work the following data can generally be relied upon: General iron, 1-120; loam work cast vertically, 1-200; brass, 1-64; phosphor bronze, 1-100; steel, 1-48; aluminum, 1-74; malleable iron, 1-64, and lead, 1-48.

PAINTING AND VARNISHING PATTERNS.

Various opinions are held by patternmakers on this subject, but all agree that patterns, except those of the most temporary kind, should be painted or varnished, as it preserves the pattern and fills up the grain of the wood, so that the

sand does not cling to it. One good method practised by some of the larger firms is to paint "black" parts that are not to be machined, "yellow" parts that are machined, and "red" for prints and parts where the core cuts thru the metal. In parted patterns the section is painted in the joint. This method enables the molder to see at once what parts are going to be machined. It also shows him the arrangement of the cores and the thickness of metal, so that he can see where to cut the runner gates to the best advantage, without having to match the core boxes with the pattern. It also assists the pattern storekeeper in getting out the different coreboxes belonging to a pattern without having to refer to his book or getting the tracing to see how many coreboxes are required.

Upon finishing a pattern all center lines should be cut in deeply with a scriber; this makes it much quicker to check the pattern, and also to make any alterations to it, as most of the principal dimensions are given from the center lines.

MARKING PATTERNS.

Makers of different kinds of machinery have systems of marking their patterns best suited to their own classes of work. Standard patterns generally have the marks cast on in raised letters or figures; these marks should also be stamped plainly on the pattern, the core boxes and all loose pieces that are used with it. A method now being employed for small patterns is to have the "pattern mark" stamped on a piece of aluminum by an automatic machine; this gives a fairly good mark on the casting if a little extra care is taken by the molder.

An Old Steam Engine.

The Museum of Master Works of Natural Science and Technics, recently established in Munich, Bavaria, has obtained, thanks to the Kupferschieferbauenden Gewerkschaft in Eisleben, a steam engine built in 1813. It gives a good idea of the essential parts of the old "fire engine." A coffer boiler, likewise ancient, illustrates the great difficulties which must have attended the construction of this essential part of the steam plant by the old-time engineers who, instead of our present huge rolled plates, had at their disposal only mean-looking forged plates of smallest dimensions. To see this boiler is to comprehend the complaint of the ancient master mechanic that his boiler would not hold tight.

The engine, with a cylinder of 36 inches diameter, was built by W. Richards. Its wooden beam did service till about 1854, when it was replaced with a gray-iron affair. To that period probably belong a Watt parallelogram, crosshead, guides, etc., but the old piston and valve remain, as well as a highly interesting valve gear with numberless levers and weights. This is arranged almost separate from the engine and gives little idea of the compact form of modern engines. The machine was in operation up to 1885.

American Manufactures Abroad.

SOUTH AFRICA.

American exporters of machinery and tools would do well to watch the South African market. There are many indications that prosperity is about to return to that country. There is a decided improvement in the output of gold. It should be carefully noted, too, that the recent South African loans placed on the London market have been readily taken. Several large cities in South Africa are raising, or have already raised, considerable sums for public and other improvements necessiting the purchase of extensive stores of manufactures from abroad. Makers of pumping plant and of windmills have an enormous scope in South Africa—particularly in the Orange River Colony, where the government is realizing every day the necessity of boring for water as much as possible, and the Land Settlement Department is offering drills at low hire to settlers and has lately bought six new Juniper drills, which are being operated with as fast as possible. As in the majority of cases, the water when found does not run out and it is necessary to use a deep-well pump, with either steam, wind, oil, or horse-power. At the Cape, also, there is quite a deal of boring being done and most of the machinery employed for this work belongs to the government.

Windmills enjoy a great deal of favor, being regarded as the most economical form of power. The types most used at the Cape are the light ones for supplying water to the flocks, and heavier ones for irrigation purposes. The following conditions should be observed if your makers want to secure orders for such motors: Lightness of build, strong pumping capacity, easy working, even in a light breeze, and simplicity of mechanism, requiring very little attention. The question of price necessarily enters a good deal into consideration, but I may add that the American- made motors have been the ones which have given the most satisfaction, and they enjoy the largest sale. Your exporters should really experience little difficulty in cultivating this trade, when we remember what enormous advantages they have over British competitors in the matter of freight charges. Whether they will be permitted to retain that advantage for an indefinite time is by no means certain.

CHINA.

Makers of gold crushing machinery would do well to note that several Peking officials have obtained the necessary permission from the authorities to start mining operations in the Wolf and Tiger mountain gold district. The funds needed to purchase crushing and other machinery are to be advanced by the Provincial Government of Shantung. The United States Consul in that locality would no doubt be able to assist your readers with detailed information.

AUSTRALIA.

Perhaps your exporters are aware that the Australian Government has imposed an import duty on trade catalogs sent to that country! It may be of practical assistance for such firms doing business with the Commonwealth to know that they can weigh the catalogs in bulk before mailing, assess the duty at 3d. (6 cents) per pound, and remit the amount involved to the Postmaster General for transmission to the Department of Trade and Customs. I refer to this because many American machine houses send a number of catalogs to Australia. They can also remit the amount direct to the Deputy Postmaster General at the chief center where the catalogs are going. The wrapper on each catalog should be stamped with the sender's name and address, and a statement added that the duty has been paid as above.

WEST INDIES.

Some months ago I advised your makers of sugar machinery to be on the lookout for business from the West Indies. There is a steady revival of the sugar industry there, and British manufacturers are doing all they can to get the trade for new plant which the cane-sugar industry must obtain if it is to maintain its position. There must soon be a general overhauling of plant out there, as the most up-to-date machinery must be used to ensure successful competition. F. C. C.

Standardization of Small Screws.

The S. I. (Système International) standard screw threads which have been introduced on the Continent as the result of the Congress of Zurich, growing out of a movement led by the Society of Encouragement for (French) National Industry, have not hitherto been extended to diameters under 6 millimeters. The frequent use, however, of smaller screws, especially in electrical work, has impelled the Professional Syndicate of Electrical Industries to propose to the first-named society that they be standardized. A proposition to this end has been formulated and submitted to anyone interested. Information may be had from the secretary of the Society of Encouragement, 44 rue de Rennes, Paris. The scheme in brief is as follows:

(1) The adoption of the following diameters (in millimeters): 2, 2.5, 3, 3.5, 4, 4.5, 5, 5.5, with corresponding pitches of 0.5, 0.5, 0.6, 0.6, 0.75, 0.75, 0.9, 0.9.

(2) The use of the S. I. outline as adopted for screws larger than 6 millimeters.

(3) For auxiliary dimensions (openings of wrenches, hight of nuts and bolt heads, etc.) the use of values approximating those now commonly employed in practise.

Monthly Meeting of the A. S. M. E. —Frazil and Anchor Ice.

The third of the season's monthly meetings in New York of the American Society of Mechanical Engineers was held at the Society House March 28. Professor Howard T. Barnes, of McGill University, Montreal, gave a valuable and highly instructive address upon "The Formation of Anchor Ice and Precise Temperature Measurements." President Freeman, whose special experience, as our readers know, has been largely in the line of hydraulic engineering, spoke, in introducing the speaker, of the serious nature of the anchor ice problem, especially to the large mill owners of New England. He said that the reductions of power and the delays and perplexities due to anchor ice were often as serious as those entailed sometimes by summer droughts. He had hopes that a systematic study of the conditions of ice formation such as had been conducted by Professor Barnes would develop some means of circumventing nature and of securing uninterrupted water-power in the winter months. It must be confessed, however, that there was little suggestion of the means of amelioration in the address which followed.

The opportunity of Professor Barnes for prosecuting this interesting line of study was right at his door. The Lachine Rapids of the St. Lawrence, just above Montreal, supply the necessary conditions as they could be found perhaps nowhere else. The investigations which began in 1896 were of an official character, being under the authorization and direction of a commission of the city of Montreal, so that the statements and deductions of Prof. Barnes are presented authoritatively. He explained quite clearly the theory of ice formation, and especially the conditions under which frazil (*frawzeel*, if you please) ice and anchor ice are formed. These two are entirely distinct, frazil ice being formed in running water, while anchor ice is formed on the bottoms of rivers. Water at the freezing point may be regarded as a saturated solution of ice which is ready at once to crystallize upon the slightest reduction of temperature, just as alum crystallizes from a saturated solution. The crystals of ice as they form readily freeze to each other as soon as they come in contact, no pressure being required to unite them, and in this way under suitable temperature conditions vast spongy masses are formed. At Montreal the frazil ice has been found packed solidly to a depth of 30 feet under the surface ice.

Anchor ice attaches to and accumulates in masses upon the bottom of a river. It forms always in the night and when the sky is clear. It forms upon dark bottoms rather than upon those of lighter color, does not form under a bridge or any other overhanging masses that may come between the water and the clear sky. The water being at or close to the freezing temperature, it is cooled so as to compel the freezing by radiating its heat up thru the water and into space. In the morning when the sun rises the heat radiation is reversed sufficiently to release the masses of ice which have formed, when they rise to the surface and are carried along by the current. At Cornwall, which is above the Long Sault Rapid, men acquainted with the river hesitate about crossing with a boat in the morning, lest a mass of anchor ice should rise under them and carry their boat helpless down the rapids.

It must be quite evident that in the study of these phenomena the most important apparatus is an instrument for reliably and minutely indicating temperatures. Such an instrument Professor Barnes has devised. This is an electrical platinum resistance thermometer which is capable of indicating differences of temperature of much less than one-thousandth of a degree Cent. The instrument, which was actually used and which was handed around thru the audience, showed a glass tube of not more than ½ inch outside diameter and a little over a foot long, with a coil of fine platinum wire in it, the two ends projecting to be connected to any length of leading wire required. This instrument is dropped into the water where it is required to ascertain the temperature, and the results are read from a galvanometer in a riverside shanty.

The astonishing revelation of this thermometer when applied to the investigation of the phenomena of ice formation is, at least to the novice, the minuteness of differences of temperature accompanying the formation of ice. While ice will not form, of course, above the freezing point, it was found that when ice formation was most active the temperature never went one-hundredth of 1 degree Cent. below the freezing point. The lowest temperature shown in an elaborate record of tests was —.004 degree Cent.

The lecture, which was long, was followed throughout with close attention by the members present, and the meeting was continued to a late hour in the answering of the numerous questions which were propounded from all sides. Altho the lecture was unwritten, its wording was careful and precise throughout, and when reproduced in full with its accompanying illustrations it must prove a valuable contribution to the transactions of the society.

On December 12 to 23 an Electrical Show will be held at Madison Square Garden, New York city, under the management of the Exposition Company of America. George F. Sever is director of exhibits.

At a test of a threshing machine in Kansas 50 bushels of wheat were run into the receiving wagon in 8 minutes. A big machine in good order and competently handled will turn out 3 bushels a minute, or about 2,500 bushels a day.

Overrated Himself.

The following we take from a "talk" by Dr. W. A. Granville before the Yale Mathematical Society as reported in the *Yale Scientific Monthly*.

Conti, himself a distinguished mathematician, said of Leibnitz that he aimed to surpass all mathematicians. There is hardly a purpose in civilized life for which he did not invent some machine, but none of the machines succeeded. The applause which rang thru Europe over the achievement of Pascal, which was regarded as a triumph of genius wholly without a parallel, fell painfully on the ear of Leibnitz. He was now in the very zenith of a glory which few men by the sheer force of intellect alone have ever attained. And yet, in the midst of all his honors, the gifted, favored, courted Leibnitz was not happy. The machine of Pascal troubled his slumbers. He resolved to create a new one that would completely eclipse Pascal's. This single project presently absorbed all his thoughts. Philosophy, chemistry, physics, mathematics, correspondence with the learned, relations with monarchs, everything he put aside that he might gather all his forces and give his whole genius and his whole time to the service of this new ambition. For four years he lived simply with one end in view, namely, to construct a calculating machine superior to that of Pascal. After having in some part perfected his device, he sent the plans of it to the Royal Society of London; and at a later period he laid them before the Academy of Sciences of Paris. According to these plans, the machine was designed to execute the four fundamental operations of arithmetic. He had expended on its construction 100,000 francs; and yet the machine was found after all to be poorly executed, uncertain in its operation and incapable of performing an addition or subtraction extending beyond four figures. To complete his humiliation, it began to be hinted, at first in timid whispers, and afterward in bold and open assertion, that the machine which had cost Leibnitz so much of his time and labor and money, was neither more nor less than an imitation, almost servile, of the contrivance of Grillet, a machine which had some time previously remarkably disappeared, having been disposed of by the inventor, no one knew where or how. Whether Leibnitz, as was maintained and believed, had really become its secret purchaser, and whether, in despair of originating anything better himself, he had finally determined to adopt it as his own, is a question which cannot of course now be ever satisfactorily settled; but it is a fact that Leibnitz's machine for practical utility was inferior to that from which he was asserted to have copied.

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505 Pearl Street, New York.

It having again become necessary for the AMERICAN MACHINIST to move its offices to a new building, this has been done and we are now located at 505 Pearl street, New York. The new location is a short distance from the former one, in a building much better adapted to our purposes and wherein we have room for all departments of the business, so that they are now together in one place instead of being scattered in three places. Our own and the offices of *Power* and of *The Engineering and Mining Journal* are now together on the top or tenth floor of the Hallenbeck building, while on the floor below we have installed the most modern and up-to-date printery and bindery that was to be obtained. It is also the largest we know of owned by a concern publishing technical or trade papers and used exclusively on its own publications. The new address, 505 Pearl street, is near Centre street, about two blocks east of Broadway and a short distance north of the City Hall and the new Hall of Records.

Uncomfortable and Unhealthy Shops.

One of our British contemporaries contains an article giving an account of the imposition of a fine upon a manufacturer in Great Britain who had women employed working in a room which was at a temperature of only 40 to 42 degrees Fahr. This is contrary to the law; hence the fine.

There is a general impression that these things are much better looked after in America than in England, and it is probable that, generally speaking, this is true; that is to say that there are comparatively few manufacturing establishments in America in which the matter of temperature is not looked after. However, it remains true that in a good many of them here little attention is given to it, and there is no adequate or systematic means of insuring that the shops shall be comfortable or healthy places for men to work in. It is within the experience of the writer that an American machine shop was for years heated by two rows of gray-iron pipes which surrounded the shop, and which had no steam in them until the engine was started in the morning, even in the coldest weather; when the engine was started these pipes received only exhaust steam and were for hours only at about blood heat. This was in a climate subject to weather running as low as 25 degrees below zero, and there is no doubt whatever but that many men working in these shops in cold weather had their vitality reduced to such an extent by the low temperature that they succumbed to it; many of those that escaped death being made sick and having their efficiency much reduced. It was a common sight to see men in this shop wrapping cloths around hand-wheels and crank handles of machine tools to make contact with them endurable, and all "winter strained lard oil" about the place had to be thawed out before it could be used. Thermometers were unknown there, but it is safe to say that on such mornings a room with a temperature of 40 degrees would have seemed quite balmy. There was not the excuse of poverty for all this, for during that period money was being made by that establishment at a rate that ought to have satisfied the most ambitious or most avaricious.

There were other abuses in the place; for instance, unmatched boards in the floors of the upper stories, between which filings and dirt of all kinds sifted on to the heads and down the backs of the workmen employed below. A workman who complained of these things was set down as a kicker and informed that the firm were not providing parlors for men to work in. This was not in England but in America. Happily the day for that sort of thing has mostly gone by, but we believe there is still too much of it, and in some places too little regard for the fact that workmen, as well as other men, have feelings and that it pays to give them decent conditions in which to work, aside from the moral duty imposed upon the owner of a shop in which men must work to earn their living.

Our Contributors and Our Work.

In the older days, before the men who are engaged in the various branches of machine construction had become accustomed to writing articles about the work they were engaged in, there were many occasions when there was in our office a rather short supply of contributions, so that, as "make-up" time approached each week there might be some little "gunning around" for material to fill up with. There is no trouble from that source now, tho the paper is much more capacious. Every winter, conditions being favorable for the production of manuscripts, letters and articles pour in upon us much faster than we can possibly find room for them, and sometimes faster than we can even give them preliminary examination. Then as warmer weather comes in, with its shorter evenings and the very proper inclination of men who are at work indoors all day to get outdoors afterward, contributions fall off and we, whose work goes steadily on at about the same rate throughout the seasons, are able to catch up.

During the past winter this accumulation has been unprecedentedly large, with the result that the advent of spring finds us with a very unusual stock of what is to us our raw material. Practically all of this has been at least glanced at sufficiently to enable us to see that it relates to subjects coming within our scope and that it is probably available and will probably be usable, as there is available time for going over it in preparation for the printer and available space in which to print it.

We hope our friends who have sent in contributions during the past few months and who have not yet seen them appear will not lose patience and will be charita-

ble enough to believe that we are doing the best we can with our own particular problem; and we especially hope that none of them will fail to send or refrain from sending to us accounts of things they think likely to be of interest because there has been delay in the apearance of a previously mailed article.

Naturally, those communications which relate to or comment upon articles previously printed are usually taken up immediately, and either printed as soon as possible or returned to the writers, but all others are considered in the order of the date of their arrival in the office. It follows from this that a contributor who has sent in, say, three communications at intervals of, say, two weeks, will have those articles acted upon at intervals of about the same time, whereas if he sends in one article and there is such an accumulation of matter that it cannot be acted upon in less than six weeks, there will be only the one article that will present itself for action within that period instead of three. The moral is obvious—*i. e.*, send in whatever may suggest itself when it suggests itself. We will examine and decide upon it as soon as practicable, and will not destroy but will return it, at our expense, if for any reason it is unavailable.

Evening Manual Training Classes.

The Ethical Culture School, which has erected an unusually fine new building at Central Park West and Sixty-third street, this city, has included in its equipment a fine shop outfit for instruction in manual training, and it is the intention to open evening classes in this subject at the next autumn session. The work will include machine-shop practise, patternmaking, blacksmithing, cabinetmaking, printing and mechanical drawing, and the instruction will be free. Thirty or forty pupils can be accommodated, and the school offers an obvious opportunity for those able to take advantage of it.

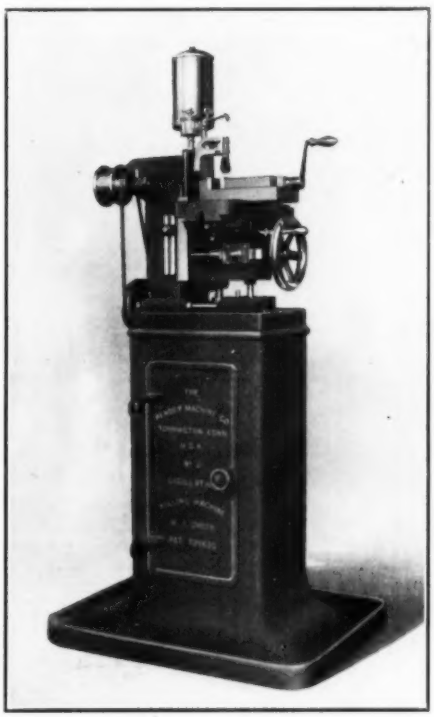
Those of our readers who have not secured them and may wish copies of the index for last year should send for them at once. They will be sent free of all cost to *any address* in response to a postal card request.

Guesstimating is not the safest estimating.

New Tools and Machine Shop Appliances.

OSCILLATING MILLING MACHINES.

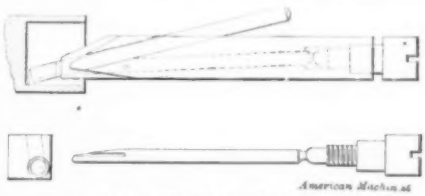
The engraving illustrates a novel machine designed for finishing awkward surfaces, cutting slots, etc., not easily machined on the ordinary miller, shaper or slotter. The machine is known as an oscillating miller, for the reason that the cutter instead of having a rotary motion is rocked back and forth about a point coinciding with the spindle axis; the cutter having radially formed teeth of V-form and cutting in both directions. The oscillating shaft carrying the cutter head and mounted at the top of the column, is actuated by means of a connecting rod from a wrist-plate mounted on the driving shaft below, the travel of the cutter being regulated by adjusting the crank-pin and plate. As will be noticed, the cutter is provided with a shank which is dovetailed into the head and is of proper length to bring the cutter central with the spindle. Teeth are cut on the face as well as on the perifery of the cutter, thus adapting it to a great variety of operations, such as slotting tool posts, cutting keyways, milling irregular openings, facing bosses, etc. It will be understood that such work as tool-post or other slotting is done after the stock has been drilled out by jigs in the usual manner, as owing to the fact that the cutter does not rotate and so clear itself, it is not intended to cut down into solid stock. The machine shown has automatic vertical feed for the knee and is the smallest of three sizes. The Hendey Machine Company, Torrington, Conn., is the builder.



OSCILLATING MILLING MACHINE.

A LATHE TOOL HOLDER.

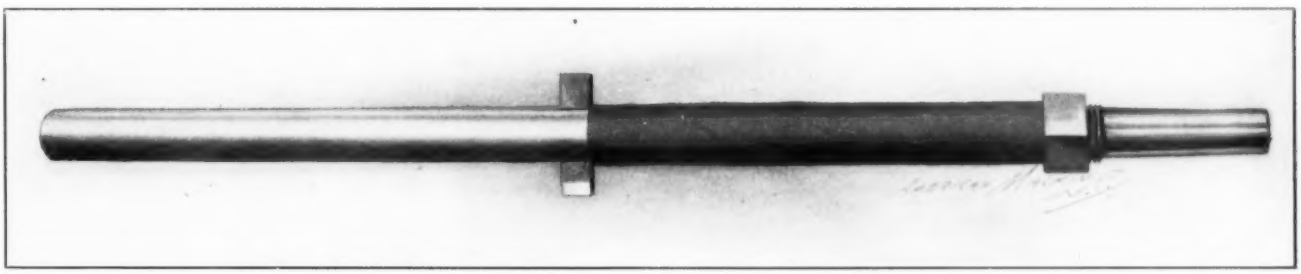
The tool here shown is the invention of two residents of Steglitz, near Berlin, Germany, and has recently been patented in the United States. The cutting point of the tool projects from or overhangs one corner of the holder, and as the holder is square and can be readily secured in either of its rectangular positions, it would seem to be handy for some special jobs of shaping or slotting work, altho it is normally intended for lathe work. With a few special tools for drilling, etc., the tool is cheaply made.



A LATHE TOOL HOLDER.

BORING BAR.

This boring bar is meant for use in hollow spindle lathes, where a bushing is put in the end of the spindle to guide the front end of the bar. It can be clamped either to the rest of an ordinary engine lathe, held in the tailstock, or used in a regular turret lathe. The new feature of the bar is the means adopted for clamping the cutters, in place of the wedges or set-screws commonly employed. Behind the slot the bar is slightly increased in diameter and on this portion is fitted a sleeve of high carbon steel which rests against the back of the cutter, the two ends of the sleeve being hardened and ground, and the cutter back being turned to just fit into the tube, which centers it nicely. The nut at the rear end clamps the cutter rig-



BORING BAR.

idly and has no tendency to spring the bar out of true. The bar is made by the Moline Tool Company, Moline, Ill.

AUTOMATIC DOWN, ANGULAR AND CIRCULAR FEED FOR SHAPER HEAD—RELIEVING ATTACHMENT FOR LATHES.

Fig. 1 shows an automatic feed for shaper head. The motion is obtained from the rack—mounted on top of the guide for the ram—meshing with a pinion which can be thrown into engagement—in either direction of its movement—with a ratchet wheel. The motion from this ratchet wheel is transmitted thru suitable gearing to a clutch controlled by the small ball handle shown back of the head. This clutch engages at will with either the down feed, or the circular feed, or may be thrown to mid-position when it is out of engagement with both.

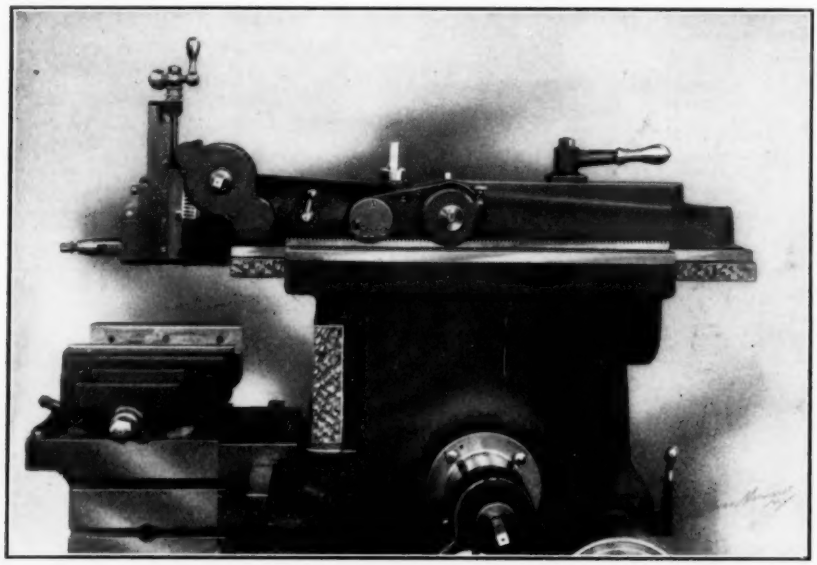


FIG. 1. CRANK SHAPER WITH AUTOMATIC DOWN, ANGULAR AND CIRCULAR FEED.

With reference to the variations of feed, the small knob on the right-hand top of gear case is connected with a worm engaging into a worm-wheel; this worm-wheel having a segmental slot into which two stops are located, one stop being fast to the friction, the other to the case, which is stationary. By rotating the knob to either right or left hand it will either lengthen or shorten the distance between the fixed stop on the case and the movable stop on the friction, thus reducing the amount of rotation of the case carrying the feed pawl, and forming a minute and accurate feed variation from one tooth to twenty-four teeth per stroke. All gears are thoroughly protected and all adjustments are on the working side of the shaper.

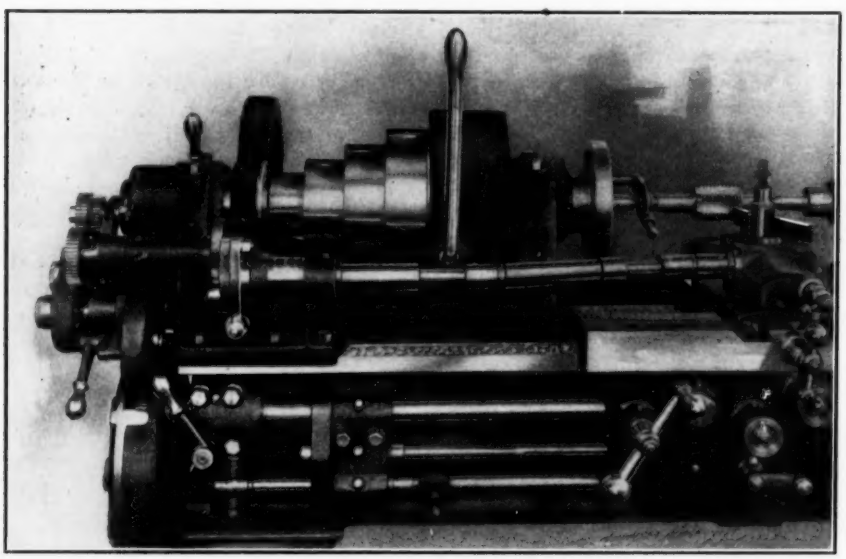


FIG. 2. RELIEVING ATTACHMENT APPLIED TO 16-INCH LATHE.

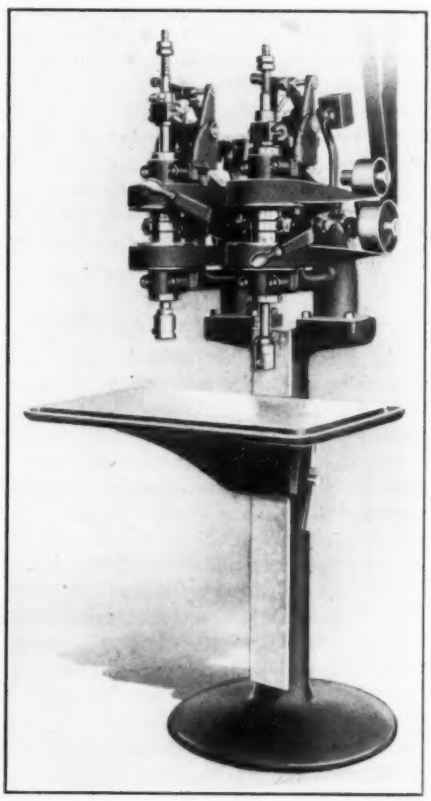
Fig. 2 shows a relieving attachment applied to a lathe. The movement to and fro of the tool slide is obtained thru the universal jointed shaft from the cam mounted on the bracket in front of the lathe. A pinion on the end of this shaft engages with a rack in the slide, thus doing away with the necessity of any springs in the compound-rest slide.

By means of change gears engaging with the gear on the stud any number of flutes may be relieved. This attachment and the one for the shaper before described are made by the Springfield Machine Tool Company, Springfield, Ohio, and applied to tools of their make.

DUPLEX VERTICAL TAPPING MACHINE.

The illustration shows a new duplex vertical automatic tapping machine designed to meet the special requirements found in typewriter, adding machine and similar work, the table being of such proportions as to give bearing surface for large frames, etc.

By a new method of construction the engaging of the forward driving friction is done entirely by an upward movement of the operating lever, instead of a downward movement of the lever, as is usual.



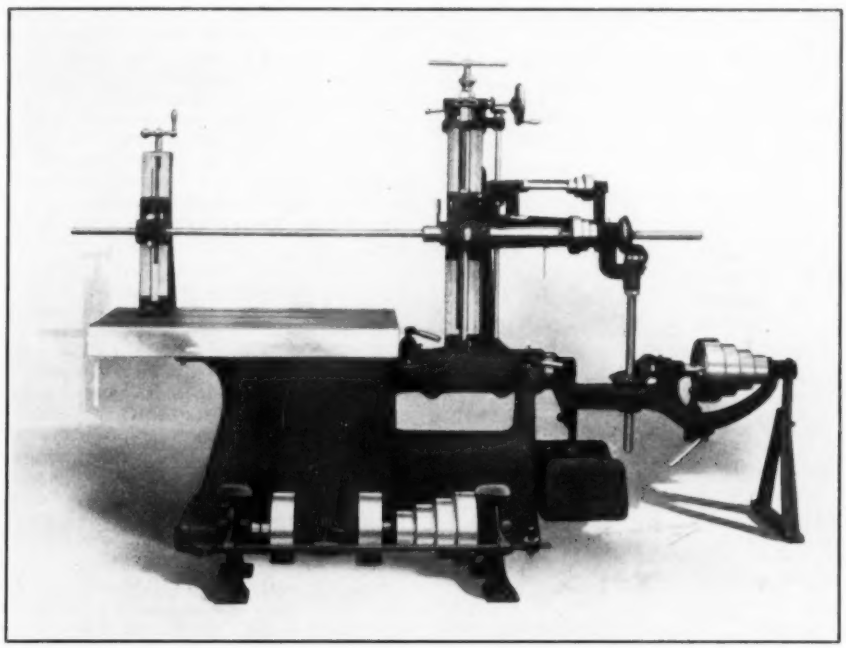
DUPLEX VERTICAL TAPPING MACHINE.

Another feature is the ability to stagger the hight of the spindles in relation to the table, which will be appreciated on work where the holes are on different planes. Thus the taps are set in correct operating relation to the holes to be tapped. The capacity of the machine is from ⅛ to ½ inch. Size of table, 16x20 inches; width of belt, 2 inches; distance from center to center of spindles, 10 inches; distance from chuck to table when down, 26 inches; distance from face of column to center of spindle, 10 inches; floor space, 30x36 inches. These machines can also be furnished with

any number of spindles required. They are built by The Grant Manufacturing & Machine Company, Bridgeport, Conn.

HORIZONTAL DRILLING, BORING AND TAPPING MACHINE.

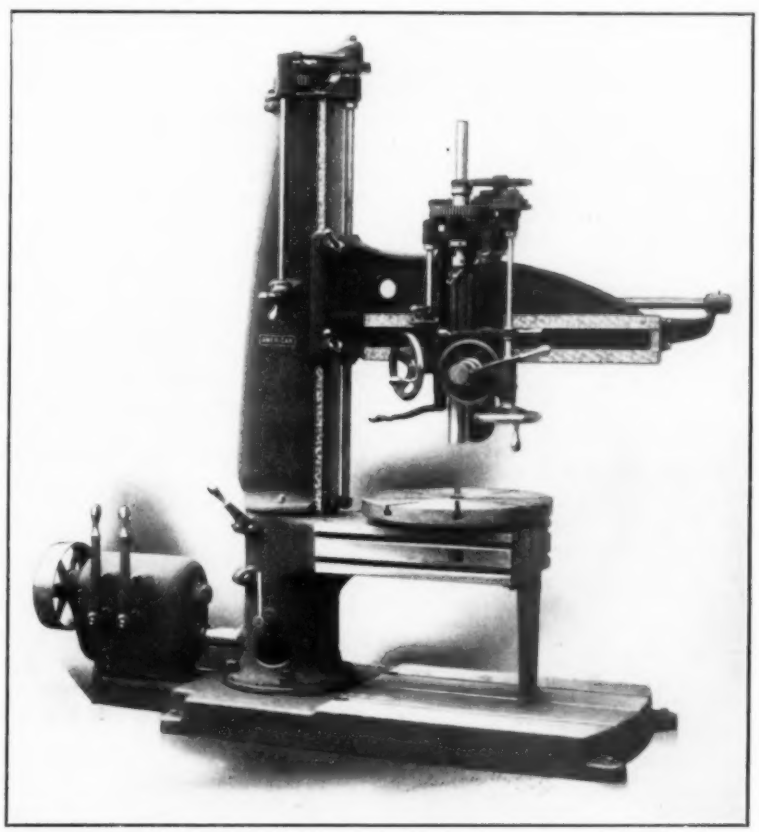
The illustration shows a machine which is practically a horizontal radial drill of the same general type as the one we illustrated and described at page 983, Vol. 23. It is very handy for drilling in the ends of long pieces. The counterbalanced upright arm swings in either direction thru 180 degrees of a circle having a radius of 24 inches. Hand and power feed and quick return, are provided for the spindle which has a traverse of 15 inches. In the present type of machine an outboard support for the boring bar is furnished, as is also a floor support for the end of the cone pulley bracket. The greatest distance from table to center of spindle—when the swinging arm is in a vertical position—is 17 inches. And when the arm is swung so that the spindle is on a level with the table, the greatest distance from the center of the table to the center of the spindle is 22½ inches. The spindle is 1 5-16 inches in diameter and is fitted with a Morse No. 3 taper. It can be furnished with 10-inch traverse of spindle, if desired. A friction countershaft is furnished with the machine. The table is 20x40 inches, with longitudinal T-slots. Floor space occupied by the machine with 15-inch spindle traverse, 96x42 inches. Net weight, 1,950 pounds. The manufacturer is the B. F. Barnes Company, Rockford, Ill.



HORIZONTAL DRILLING, BORING AND TAPPING MACHINE.

THREE-FOOT ARM RADIAL DRILL.

The illustration shows a radial drill press which is supplied with either cone pulley or speed box drive. There are four gradations of geared feed from .007 to .041 in geometric progression, all obtained by turning a dial on the feed box till the desired feed comes opposite a fixed pointer. The spindle is graduated, and all feeds can be automatically tripped at any position of the spindle. The speed box of the geared friction type provides four changes of speed, each instantly obtainable by the two levers shown. The spindle has eight changes of speed from 13 to 300 turns per minute in geometrical progression, each available without stopping the machine. The column is supported on a stump carrying conical rollers and can be clamped in any position. The arm is raised and lowered by power; its under edge is straight, thus permitting work to be operated upon close to the column without necessitating an extreme reach of the spindle. The back gears in the head may be engaged or disengaged while the machine is in motion without shock. With this machine no wrenches are necessary, as all binding screws are provided with handles. The machine is built by the American Tool Works Company, Cincinnati, Ohio.



3-FOOT ARM RADIAL DRILL.

New Publications.

Progress Reporter for April, published by the Niles-Bement-Pond Company, is a magnificent number. Its topic is "Locomotive Manufacture," and it tells its story graphically. It contains four dozen 9x6¼ half-tones showing a great variety of machine tools in actual operation at the Schenectady works of the American Locomotive Company. The pictures leave little room for words, and in this case they would be superfluous.

"American Toolmaking and Interchangeable Manufacturing." By Joseph V. Woodworth. 534 6x9-inch pages, cloth. The Norman W. Henley Publishing Company. New York. Price $4.

Tho toolmakers of experience and who also keep up with the literature of their vocation may not find so very much that will be new to them in this book, it is, nevertheless, an intelligent presentation of the subjects it treats, and will undoubtedly

prove of very great value to many who have to do with manufacturing operations. Very much attention is given to jig designing and making—more, perhaps, than to any other one subject, tho milling machine work and fixtures, turret-machine tools and fixtures, broaches and broaching, precision measuring tools and their use, mold construction (metal molds), die work, sub-presses, engraving and die-sinking, swaging, etc., are also fully discussed. The book is replete with illustrations, none of which has been previously used in catalogs or elsewhere, but all are made for the book, which is one that every mechanic or manufacturing establishment engaged in systematic manufacturing operations will find good use for. We would prefer to mention no defects in a book so excellent, but lest by our silence we be taken as endorsing some things we do not endorse, we speak of the author's queer use of dotted lines joining utterly unimportant points of different views of the same piece. These seem to be used throughout in place of center lines, which latter are nowhere used at all, altho of course there are plenty of places in which they should have been. This leads to an annoying and misleading result, particularly at page 142, where the queer lines referred to, instead of being dotted as usual, have inadvertently been left full, and the drawing is consequently not understandable until one perceives what is the matter with it. Some exception might be taken also to the presentation of a milling fixture shown at page 146 as being adapted for allowing "the work to be fastened or removed with the greatest rapidity." This is a fixture for holding a number of pieces in a string, and for each piece a set-screw and a nut must be tightened when putting in and loosened when removing, and a wrench that must be picked up for the purpose must be used. A fixture that we should consider really fast for such a purpose would at least have attached handles to each screw and nut, and, better yet, would probably do away with both in favor of some form of eccentric or lever fastening. The fixture is a good one and would be used in many places; the only error is in speaking particularly of its rapidity in putting in and removing the work. Another point that perhaps should be mentioned is that wherever a section of a fixture to be screwed on to the spindle of a lathe or screw machine is given, the thread is shown to be left-handed. This is a common mistake, made by a great many others besides the author. It could not of course cause the thread to be so cut, but it is a little better to have such things right in a book. These are minor defects, however, which may easily be amended in future editions if thought to be worth while. The book merits future editions, for it is, we think, a useful addition to the literature of the American machine shop, or, rather of the machine manufacturing establishment.

Personal.

E. H. Mumford and C. S. Lovell, formerly of the Tabor Manufacturing Company, of Philadelphia, have formed the E. H. Mumford Company for the manufacture of foundry molding machinery of all descriptions.

W. C. Johnson, formerly with the W. H. Foster Company, of New York, is now representing the Diamond Drill & Machine Company, of Birdsboro, Pa., manufacturer of Wagner cold saws, Jackson belt-lacing machine, punches, shears, steel and iron castings, etc.

George B. Damon, who has been manager of the New York office of the Wellman-Seaver-Morgan Company, has been transferred to an important position at Cleveland, and W. A. Stadelman, for the past ten years manager of the Eastern office of the Brown Hoisting Machinery Company, assumes the position vacated by Mr. Damon.

Obituary.

Duncan Symington, for many years superintendent of the Frontier Iron Works and the Northern Engineering Works at Detroit, Mich., died at Detroit March 21.

John O'Brien, president of the boiler works bearing his name, died at his home in St. Louis, Mo., March 16, sixty years old. Mr. O'Brien was a native of Ireland, but learned his trade in this country and started in business for himself in 1872.

James Madison Seymour, mayor of Newark, N. J., for three consecutive terms and an expert in gun manufacture, died at Newark, April 1, sixty-seven years old. Early in the Civil War he was superintending the manufacture of gun machinery for the Spanish Government, but later he was engaged in the same line in this country. In 1865 he with Daniel Whitlock formed the firm of Seymour & Whitlock, builders of machinery at Newark, this firm still existing.

Jabez H. Gill, master armorer at the Frankford Asenal, Philadelphia, died March 27. Mr. Gill was first employed at the arsenal forty years ago, or before the close of the Civil War. He had been master armorer twenty-one years, and was superintendent for a number of years before that. He was the originator of a number of improvements in ordnance, including small arms and seacoast artillery. An official letter of the commandant was issued in commendation of his high record for skill and inventive talent, for strict integrity, the conscientious performance of duty and readiness to respond to all requirements.

Inquiry for Machinery.

(181) We have an inquiry for makers of machines and equipment for a small plant for the manufacture of tinfoil, with a capacity of 300 to 500 pounds output per minute.

Business Items.

The Taylor-Wilson Manufacturing Company, Allegheny, Pa., has taken over the foundry and machine business formerly conducted by Taylor, Wilson & Co., Ltd.

The Dodge Coal Storage Company has acquired the business of the United Telpherage Company, of New York. Communications intended for the latter company should be addressed to "The United Telpherage Department" of The Dodge Coal Storage Company, 49 Dey street, New York.

The Ridgway Machine Tool Company, of Ridgway, Pa., manufacturer of heavy boring mills, radial drills, lathes, planers, hydraulic presses and the like, will be represented in New York by the Prentiss Tool & Supply Company; in Chicago by the Marshall & Huschart Machinery Company; in Pittsburg by the Baird Machinery Company, and in Cleveland by the Motch & Merryweather Company.

Dodge & Day, engineers, Philadelphia, Pa., who were commissioned some time since by the Lehigh Coal & Navigation Company to take charge of its extensive shop improvements at Lansford, Pa., including new buildings, machine tools and electrical equipment—in fact all details in connection with such a layout—have been further commissioned to take charge of the erection of a new centrally located power plant. This plant will provide current for the shops, Tamaqua & Lansford Street Railway, and electrical equipment which will be installed in the mines for pumping and transportation purposes.

The National Electric Company, Milwaukee, Wis., has recently installed an electric light plant in the Cook County Court House, Chicago. The generating machinery consists of one 100-kilowatt and one 150-kilowatt, direct-current, engine-type, six-pole generator, direct connected to engines of the four-valve, single-cylinder type, the former running at 225 revolutions per minute, and the latter at 200 revolutions per minute. The engine-room is in the basement of the Court House, and the whole equipment is interesting as indicating the tendency of municipal bodies in America toward ownership of plants of this nature.

S. S. Eveland, vice-president and general manager of the Standard Roller Bearing Company, Philadelphia, Pa., has just purchased for that company all the machinery, merchandise, assets and good will of the steel ball business of the Federal Manufacturing Company, Cleveland, Ohio. The Standard Roller Bearing Company about a year ago bought and transferred to Philadelphia the ball business and machinery of the Grant Ball Company, of Cleveland, Ohio and Franklin, Pa., since which time they have turned out from four to five million balls a week. The Federal Company's plant will also be moved to Philadelphia, which will give the Standard Roller Bearing Company a capacity of over 500 million balls per week. The assets of the Federal Company secured by the latter company consist of about 300 machine tools of various descriptions, 5,000 small tools and over 100 million steel, brass and bronze balls of all sizes, such as are used in bicycles, ball bearings, roller bearings, etc. The Standard Roller Bearing Company during the past year has built and equipped a large addition to its factory in Philadelphia at a cost of over $300,000. Its main factory consists of a building 500 feet long by 150 feet wide, and another, of three stories, 70 by 260 feet. There are also a large foundry, forging and blacksmith shop, hardening room, etc., giving a total floor space of over 100,000 square feet. An additional piece of ground has recently been purchased, measuring 300 by 200 feet, adjoining its factory, upon which another addition will at once be erected to

accommodate the machinery purchased from the Federal Manufacturing Company. The ball making is directly under the charge of Robert H. Grant, superintendent of the Standard Roller Bearing Company, who was formerly manager of the Grant Ball Company, where he had eighteen years' experience in the manufacture of steel balls. Thomas J. Heller, who represented the Federal Manufacturing Company for a number of years in New York, having entire charge of the Eastern business, will continue as manager of the ball sales department. F. M. Germane, who for a number of years had charge of the Western territory for the Federal Manufacturing Company, will be Western sales manager for the Standard Company, with headquarters in Chicago, where he will carry a full line of steel balls, roller and ball bearings, etc. At present he will run the Federal ball plant for the Standard Roller Bearing Company until it is moved to Philadelphia in June.

New Catalogs.

B. F. Barnes Company, Rockford, Ill. Circular illustrating and describing horizontal drilling, boring and tapping machine. 6x9, pp. 4.

The Hendey Machine Company, Torrington, Conn. March, 1905, catalog of oscillating milling machines. Illustrated. 6x9, pp. 8, paper.

G. A. Gray Company, Cincinnati, O. Catalog describing electric motor drive as applied to the planers made by this company. Illustrated. 6x9, pp. 15, paper.

The E. F. Reece Company, Greenfield, Mass. Circular entitled "Some Good Reasons Why," containing a description of the Reece screw plates and dies. It is illustrated, and sent to anyone on request.

Curtis & Co. Manufacturing Company, St. Louis, Mo. 1905 catalog of pneumatic appliances, including air compressors, pneumatic hoists and traveling cranes. This contains numerous illustrations and tables and will be sent free on application. 6x9, pp. 80, paper.

Boston Gear Works, Purchase and Pearl street, Boston, Mass. Catalog "E" of standard gears, containing list of specialties for 1905, such as bevels, spurs, internals and racks, etc. Illustrated. 5x8, pp. 57, paper. Supplementary Catalog "W" of automobile gears and supplies. Illustrated, 5x8, pp. 55, paper.

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Punches & dies. Wal.M.Wks., Waltham, Mass.

Wire and sheet metal working machinery and tools. Emmons Collins, Chicago.

Wanted—Giant keyseater, No. 3. Address "Gears," care AMERICAN MACHINIST.

Light drop forgings to order in quantities. Remington Arms Company, Ilion, N. Y.

Will buy or pay royalty for good patented machine or tool. Box 282, AMER. MACHINIST.

Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N. J.

Working drawings, tracings. Geo. M. Mayer, M. E., 1131 Monadnock, Chicago, Ill.

Wood patterns of every description; high-grade gas engine work a specialty. Trenton Pattern Works, Trenton, N. J.

Automatic and intricate machines designed, ideas developed, by an expert. Can I help you? Box 496, AMERICAN MACHINIST.

Dies, jigs and fixtures; tools designed for special work; manufacturer of clockwork specialties and intricate mechanical instruments. D. S. Plumb, 57 E. Park st., Newark, N. J.

Up-to-date plant, equipped for manufacture of medium size machinery, will take contract for automatic or interchangeable machinery on which careful work is desired. Box 396, AMERICAN MACHINIST.

Agent wanted in every machine shop for new Wiet-Goethe caliper gauge; $20 worth of tools for $2; double your daily wages while selling them and still work at your trade; big profits. Address for particulars, Wiet-Goethe Company, Sacramento, Cal.

A Continental firm of machine tool importers, having large showroom in Paris, excellent connection and staff of travelers, require sole agency for first-class make of upright drilling machines up to 42 in. size, for France, Belgium and Switzerland. Reply Box 462, AMERICAN MACHINIST.

Modern foundry and machine shop, fully equipped for light and medium heavy work, wishes to manufacture engines, machines or machine parts; would undertake sale if desired; castings made in malleable, gray, brass, bronze and aluminum. Trenton Malleable Iron Co., Trenton, N. J., and 26 Cortlandt st., New York.

Business Opportunities.

A well-known foundry company can use a good superintendent, a good architectural draftsman, a shipping clerk and a good salesman; investment from $2,500 to $10,000 required in preferred stock, amply secured and dividend-paying; salary from $1,200 to $5,000. Address Box 485, AMERICAN MACHINIST.

Wanted—A Manager.—A good business man who desires to live South can buy an interest in and take charge of an already well-established machine shop and manufacturing plant, located at the junction of two railroads in one of the highest and healthiest sections of central Florida. Capital now invested, about $15,000. The present manager desires to retire from business, therefore this entire plant can be bought, or will be incorporated and present owners take stock in new company if desired. Here is a good opportunity for the right man who has sufficient capital and can successfully manage an already well-established business. For fuller particulars address Salem Iron Works, Winston-Salem, N. C.

For Sale.

For Sale—Royal gas machine; capacity 2½ barrels; $50. Box 2, North Wales, Pa.

For Sale—Machine shop in southern Michigan; good, live, paying business. Address Box 494, AMERICAN MACHINIST.

For Sale—Long-established machine shop in this thriving city; cause of sale, death in firm. W. D. Judson, New Haven, Conn.

For Sale—Foundry and machine shop in town of 3,000, central Minnesota; well equipped for repairing and manufacturing; nearest competition 70 miles. Address Box 890, Litchfield, Minn.

For Sale or for Rent—Thoroughly equipped modern machine shop, in good locality; excellent opportunity for anyone with money to get into a good business immediately. Box 459, AMERICAN MACHINIST.

I can sell your machine shop (or other business), with or without real estate, no matter where it is or what it is worth. Send description, state price and learn how. W. M. Ostrander, 111 North American Bldg., Philadelphia.

For Sale—A very desirable machine and repair shop, residence, location and business; manufacture wood-sawing machinery, which is in great demand; more business than can attend to; want to retire; a bargain. Irving Fox, Rochester, Minn.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be enclosed to unknown correspondents. Only bona-fide situation want or help want advertisements inserted under this heading. Agency advertisements must be placed under Miscellaneous Wants.

Situations Wanted.

Classification indicates present address of advertiser, nothing else.

CONNECTICUT.

Superintendent.—Light machinery, brass and wire goods; American; age 36; at liberty about May 1. Box 493, AMER. MACH.

DISTRICT OF COLUMBIA.

Draftsman, experienced, seeks position. Box 470, AMERICAN MACHINIST.

GEORGIA.

Manager or superintendent, by well-known mechanical engineer and inventor, thoroughly acquainted with design and manufacture of fine tools, models, dies and automatic machines; inventor and designer of machines taking grand prize at St. Louis; best references as to character, habits and ability. Address Box 495, AMERICAN MACHINIST.

ILLINOIS.

Member A. S. M. E., 10 years as chief draftsman and leading designer of hoisting machinery; steam, electric, hydraulic and hand cranes; traveling, gantry, R. R. wrecking, jib, pillar, etc., 1 to 150 tons; also proposals, specifications and shop methods of building cranes; seeks wider field than present employers can offer. Box 500, AM. M.

MASSACHUSETTS.

Mechanical draftsman wishes position. Address Box 476, AMERICAN MACHINIST.

Tool grinder, wide experience, capable taking charge, wants change; any State. Box 505, AMERICAN MACHINIST.

NEW YORK.

Position as purchasing agent; hardware or mill supply. Box 508, AMER. MACHINIST.

Mechanical draftsman, age 24, desires position; salary $18. Box 504, AMER. MACH.

Mechanical draftsman, age 24, for detailing and tracing, wants position. Box 506, AMERICAN MACHINIST.

Draftsman; experience general, special machinery; New York or New Jersey preferred. Box 485, AMERICAN MACHINIST.

Position as foreman patternmaker or assistant machine or general jobbing in city. Box 507, AMERICAN MACHINIST.

Mechanical draftsman (graduate), age 25, with shop and office practice, desires position. Box 516, AMERICAN MACHINIST.

Expert draftsman, 6 years' experience, technical graduate, 30 years age, wants position; salary $20 a week. Box 488, AMER. MACH.

Experienced machinist, toolmaker and designer; tools, jigs, fixtures, experimental work and automatic machinery. Box 510, AMERICAN MACHINIST.

Draftsman, mechanical, technical, having 6 years' shop and drawing-room experience on tools and fixtures; best references. Box 512, AMERICAN MACHINIST.

Wanted—Position (West preferred) by draftsman and designer of automatic and other machines; best of experience. Address Box 479, AMERICAN MACHINIST.

Machinist, tool, die and jig maker, 3 years foreman, age 29, would engage with growing concern where industry with experience is wanted. Box 468, AMERICAN MACHINIST.

Good machinist, 33 years; has been foreman in a well-known New York machine shop; wishing work where there is opportunity for advancement; good reference. Box 515, A. M.

Mechanical engineer, expert designer, technical graduate, experienced as consulting engineer, thorough knowledge patent practice, desires position as assistant consulting engineer. Box 489, AMERICAN MACHINIST.

Superintendent—Hustling, aggressive and capable; knows how to get the work out accurately, cheaply and plenty of it; can show results in estimated time; designer, tool and die maker by profession; in charge for 9 years. Box 517, AMERICAN MACHINIST.

Position, assistant superintendent or charge medium size plant; machinist; technical graduate; executive ability; thorough knowledge production and costs; general manufacturing experience; references; age 30. Address Box 497, AMERICAN MACHINIST.

Mechanical engineer, 12 years' experience, desires change; up to date on tools and fixtures, cost reduction and shop management; successful in the design and construction of hoisting and conveying machinery; experienced estimator and correspondent. Box 486, AMERICAN MACHINIST.

PENNSYLVANIA.

Designing draftsman; technical, practical and successful on special machinery and tools for interchangeable manufacturing. Box 491, AMERICAN MACHINIST.

Technical graduate, 8 years' experience in engine work and general and commercial engineering, desires to change responsible position. Box 471, AMERICAN MACHINIST.

Draftsman (mechanical engineer), with experience in steam engines, hoisting and mining machinery and wire rope tramways, wants position. Box 502, AMER. MACHINIST.

Position as superintendent or foreman, by up-to-date mechanic; 15 years' experience in similar positions; wide experience cost reducing; estimates, piece work, etc. Box 501, AMERICAN MACHINIST.

Toolmaker, with technical education and extensive experience on special machinery and tools for manufacturing purposes, would like charge of a toolroom with a live Western concern. Box 492, AMERICAN MACHINIST.

WEST OF MISSISSIPPI.

Experienced, all-round machinist, technical graduate, desires beginning position as draftsman in a manufacturing or constructing company. Address Z. H., 552 Baden ave., St. Louis, Mo.

Wanted—By technical graduate with 4 years' experience as mechanical and electrical draftsman, position as draftsman; Middle West or South preferred. Address Box 487, AMERICAN MACHINIST.

Help Wanted.

Classification indicates present address of advertiser, nothing else.

CANADA.

Wanted—A general foreman, thoroughly versed in modern foundry and machine shop methods. Address Laurie Engine Co., Montreal, Canada.

Wanted—A mechanical superintendent for one of the largest and best equipped machine tool, press and general machinery plants in Canada; one who will take a reasonable financial interest in the business; must have thorough knowledge of costs, handling men, master details, produce results and be capable of producing accurate interchangeable work advantageously; state age, experience, last positions filled, references and salary wanted. Box 511, AMERICAN MACHINIST.

CONNECTICUT.

Wanted—Six first-class patternmakers on heavy machinery work; good wages; no trouble. Address Farrel Foundry & Machine Co., Ansonia, Conn.

Wanted—Model maker in a large, steady-running, old-established factory, 100 miles from New York city; state age, experience and wages wanted, habits, etc. Box 481, AMERICAN MACHINIST.

DISTRICT OF COLUMBIA.

Draftsmen Wanted.—An examination for marine engine and boiler draftsmen and assistant marine engine and boiler draftsmen, to provide an eligible list from which appointments will be made in the Naval Service at any time within three years thereafter, will be held at the Navy Yards Boston, New York and Washington, D. C., continuing through April 27, 28 and 29, 1905, between the hours of 9.30 A. M. and 4 P. M., each day. The examinations will be identical at all the Yards, and will be practical in character. Applications for permission to be examined, designating also the Yard most convenient for the applicant, should be made previous to April 22, 1905, to the Secretary of the Navy, Navy Department, Washington, D. C., who will supply the necessary forms and instructions. Pay $3.52 to $5.04 per diem.

ILLINOIS.

Patternmakers.—An old-established manufacturing concern has vacancies for patternmakers, experienced in steam engine and similar patterns. Address, stating full particulars, Questor, Box 514, AMER. MACHINIST.

INDIANA.

Wanted—Machinist; a first-class man as fitter on screw machines. Box 392, AM. M.

Owing to increase in business we have openings for first-class lathe hands, machinists, vise, floor men and automobile assemblers; modern tools; high-grade work; steady positions for the right men. Address Nordyke & Marmon Co., Indianapolis, Ind.

MASSACHUSETTS.

Wanted—Machinist, experienced on small brass gear work. Address Boston Gear Works, Boston, Mass.

Wanted—A competent designer and manufacturer of forge and ventilator blowers. Box 463. AMERICAN MACHINIST.

Wanted—A man to operate Brown & Sharpe 00 screw machine; one accustomed to small and accurate work. Write or call, E. Howard Watch Co., Waltham, Mass.

Wanted—Young man, mechanical tastes, for office of gear jobbing firm; one familiar with gears preferred; state age and experience. Address Box 509, AMER. MACHINIST.

Wanted—Young technical graduates, both electrical and mechanical engineers, for testing steam turbines and electric generators. Apply to Testing Department, General Electric Company, West Lynn, Mass.

NEW JERSEY.

Lathe, planer and boring mill operators wanted for night shift; those accustomed to machine tool work preferred; steady work and good pay to good men. Address The Pond Machine Tool Co., Plainfield, N. J.

Machinist wanted to operate universal milling machine on accurate work in toolroom of large factory in New Jersey; applications from machinists and toolmakers capable of doing first-class work only considered. Address Box 499, AMERICAN MACHINIST.

NEW YORK.

A general engineering company requires 1 or 2 first-class mechanical draftsmen; must be quick, accurate and practical; shop experience essential. Address Box 518, AM. M.

Wanted—A few first-class erectors, accustomed to Corliss engine work, large waterworks engines and large gas engines; amateurs need not apply. The Snow Steam Pump Works, Buffalo, N. Y.

A first-class designer of wood-working machinery, with knowledge of power transmission machinery; state experience, where formerly employed, age and salary expected. Answer P. A., care AMERICAN MACHINIST.

Several good detail draftsmen and tracers wanted by large concern in New York city, on work similar to light wood and iron construction; state age, salary expected and two business references. Box 503, AM. MACH.

Wanted—Competent draftsmen, familiar with jig, tool and fixture work; only those with considerable experience in these three classes need apply; good position for competent party. Address B. M. W. Mfg. Co., care AMERICAN MACHINIST.

Wanted—A first-class foreman for a manufacturing machine shop employing up to 50 men; must be thoroughly skilled in the latest methods and tools and possess good executive ability; must be able to manufacture small steam engines and allied machinery in the most economical manner; salary commensurate. Box 498, AMER. MACHINIST.

Wanted—Assistant superintendent for electric shops working 350 men on electric motors, controllers, etc.; must have had thorough training in this work; know how to handle men; fully posted on up-to-date manufacturing methods and on economical production; young man preferred; give full particulars of past and present connections and state salary expected. Box 490, AM. MACH.

OHIO.

Wanted—Two or three first-class draftsmen; none without crane experience considered. Apply to The Case Manufacturing Company, Columbus, Ohio.

Wanted—A man who can and will sell machine knives; only an expert salesman need apply, or one who could at once handle the trade; give reference. Address O. K., care AMERICAN MACHINIST.

PENNSYLVANIA.

Machine and floor hands, familiar with machine tool work. Standard Engineering Works, Ellwood City, Pa.

Experienced mechanical draftsman wanted at once at steel works in Eastern Pennsylvania. "Mechanical," care AMER. MACH.

Experienced locomotive draftsman wanted at once; competent to act as leading man on detail and elevation work. H. K. Porter Co., Pittsburgh, Pa.

Wanted—First-class patternmakers, roll turners, molders, machinists, blacksmiths and brass workers; good wages; steady employment. Apply or address The Manufacturers' Association of Pittsburg, 903 Lewis Block, Pittsburg, Pa.

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Ingersoll-Sergeant Drill Co., New York.

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Schieren & Co., Chas. A., New York.
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Wiley & Russell Mfg. Co., Greenfield, Mass.
Williams Tool Co. Erie, Pa.

Bone for Case-Hardening
Rogers & Hubbard Co., Middletown, Conn.

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Baird & Co., Henry Carey, Philadelphia, Pa.
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Modern Mchy. Co., Chicago, Ill.
Tribe, Jas., Milwaukee, Wis.
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Armstrong Bros. Tool Co., Chicago, Ill.
Walker & Co., O. S., Worcester, Mass.

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Athol Mach. Co., Athol, Mass.
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Boston Gear Works, Boston, Mass.

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Case-Hardening
Rogers & Hubbard Co., Middletown, Conn.

Carriage Turrets
Fay & Scott, Dexter, Me.

Castings, Brass and Bronze
Nolte Brass Co., Springfield, O.
Phosphor Bronze Smelting Co., Philadelphia, Pa.

Castings, Die Molded
Franklin Mfg. Co., Syracuse, N. Y.

Castings, Iron
Diamond Drill & Mch. Co., Birdsboro, Pa.
Farrel Fdry. & Mach. Co., Ansonia, Conn.
Massey Mach. Co., Watertown, N. Y.
National Elevator & Mach. Wks. Honesdale, Pa.
Poughkeepsie Fdry. & Mach. Co., Poughkeepsie, N. Y.
U. S. Foundry & Sales Co., South Norwalk, Conn.

Castings, Machine
National Elevator & Mach. Co., Honesdale, Pa.
Poughkeepsie Fdry. & Mach. Co., Poughkeepsie, N. Y.

Castings, Motor
Harrison, H. K., St. Paul, Minn.
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Diamond Drill & Mach. Co., Birdsboro, Pa.
Farrel Fdry. & Mach. Co., Ansonia, Conn.

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Clark Cast Steel Cement Co., Shelton, Conn.

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Hendey Mach. Co., Torrington, Conn.
Phoenix Mfg. Co., Hartford, Ct.
Pratt & Whitney Co., Hartford, Conn.
Whiton Machine Co., D. E., New London, Conn.

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Goodell Mfg. Co. Greenfield, Mass.

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New Haven Mfg. Co., New Haven, Conn.
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Chains, Driving
Boston Gear Works, Boston, Mass.
Federal Mfg. Co., Cleveland, O.
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American Tool Works Co., Cincinnati, O.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Automatic Mach. Co., Cleveland, O.
Draper Mach. Tool Co., Worcester, Mass.
Gisholt Mach. Co., Madison, Wis
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
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Warner & Swasey Co., Cleveland, Ohio.
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Niles-Bement-Pond Co., New York.
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Chucks, Magnetic
Walker & Co., O. S., Worcester, Mass.

Chucks, Planer
Niles-Bement-Pond Co., New York.

Chucks, Split
Faneuil Watch Tool Co., Boston, Mass.
Hardinge Bros., Chicago, Ill.

Circuit Breakers
Electric Controller & Supply Co., Cleveland, O.
General Electric Co., New York.
Stanley Elec. Mfg. Co., Pittsfield, Mass.

Clutches, Friction
Caldwell, Son & Co., H. W., Chicago, Ill.
Cresson Co., Geo. V., Phila., Pa.
Faneuil Watch Tool Co., Boston, Mass.
Johnson Mach. Co., Carlyle, Hartford, Conn.
New Haven Mfg. Co., New Haven, Conn.
Niles-Bement-Pond Co., New York.
Patterson, Gottfried & Hunter, Ltd., New York.
Smith Co., Chas. G., Pittsburg, Pa.

Clutches, Magnetic and Electrical
Electric Controller & Supply Co., Cleveland, O.
Williams Elec. Mach. Co., Akron, Ohio.

Coils
Standard Welding Co., Cleve., O.

Compound, Pipe Joint
Dixon Crucible Co., Jos., Jersey City, N. J.

Compressors, Air
Blaisdell Machy. Co., Bradford, Pa.
Christensen, N. A., Milwaukee, Wis.
Curtis & Co. Mfg. Co., St. Louis, Mo.
General Pneumatic Tool Co., Montour Falls, N. Y.
Herron & Bury Mfg. Co., Erie, Pa.
Ingersoll-Sergeant Drill Co., New York.
International Steam Pump Co., New York.
Rand Drill Co., New York.

Cones, Friction
Evans Friction Cone Co., Boston, Mass.

Connecting Rods and Straps
Leard, Wm. E., New Brighton, Pa.
Standard Connecting Rod Co., Beaver Falls, Pa.
Tindel-Morris Co., Eddystone, Pa.

Contract Work
Blanchard Mach. Co., Boston, Mass.

Controllers and Starters, Electric Motor
American Elec. & Controller Co., New York.
Cutler-Hammer Mfg. Co., Milwaukee, Wis.
Electric Controller & Supply Co., Cleveland, O.
General Electric Co., New York.
Westinghouse Elec. & Mfg. Co., Pittsburg, Pa.

Coping Machines
Long & Allstatter Co., Hamilton, Ohio.
Niles-Bement-Pond Co., New York.

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Slocomb Co., J. T., Provi., R. I.

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Almond Mfg. Co., T. R., Brooklyn, N. Y.
Builders' Iron Fdry., Prov., R. I.
Wilmarth & Morman Co., Grand Rapids, Mich.

Counters, Machinery
Durbrow & Hearne Mfg. Co., New York.

Counting and Printing Wheels
Franklin Mfg. Co., Syracuse, N. Y.

Couplings, Shaft
Almond Mfg. Co., T. R., Brooklyn, N. Y.
Caldwell & Son Co., H. W., Chicago, Ill.
Cresson Co., Geo. V., Phila., Pa.
Davis Mach. Co., W. P., Rochester, N. Y.
Electric Controller & Supply Co., Cleveland, O.
Nicholson & Co., W. H., Wilkesbarre, Pa.
Niles-Bement-Pond Co., New York.
Patterson, Gottfried & Hunter, Ltd., New York.

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Brown Hoisting Mach. Co., New York.
Byram & Co., Inc., Detroit, Mich.
Case Mfg. Co., Columbus, O.
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Cleveland Crane & Car Co., Wickliffe, O.
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Curtis & Co. Mfg. Co., St. Louis, Mo.
General Pneumatic Tool Co., Montour Falls, N. Y.
Lane Mfg. Co., Montpelier, Vt.
Maris Bros., Philadelphia, Pa.
Niles-Bement-Pond Co., New York.
Northern Engineering Works, Detroit, Mich.
Obermayer Co., S., Cincinnati, O.
Pawling & Harnischfeger, Milwaukee, Wis.
Sellers & Co., Wm., Phila., Pa.
Vandyck Churchill Co., New York.

Crank Pin Turning Machine
Niles-Bement-Pond Co., New York.
Underwood & Co., H. B., Philadelphia, Pa.

WHITNEY CHAINS

THE WHITNEY MFG. CO.

Hartford, Conn., U. S. A.

Chain Department

Roller Chains.
Block Chains.
"Wizard" Chains.

Machine Department

Hand and Weight (Feed) Milling Machines.
20" Water Tool Grinders.
Vertical Automatic Drilling Machines (For Long Holes).

Miscellaneous Department

Keys and Gutters for the Woodruff Patent System of Keying.

Presto Drill Chucks, Collets and Friction Tapping Devices.

Sprockets for "Wizard" Chains.

WHITNEY
PAT. SEPT. 1904.

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Leard, Wm. E., New Brighton, Pa.
Standard Connecting Rod Co., Beaver Falls, Pa.
Tindel-Morris Co., Eddystone, Pa.

Crucibles
Dixon Crucible Co., Jos., Jersey City, N. J.

Cupolas, and Ladles, Foundry
Byram & Co., Inc., Detroit, Mich.
Northern Engineering Works, Detroit, Mich.
Obermayer Co., S., Cincinnati, O.
Paxson Co., J. W., Phila., Pa.
Stevens, F. B., Detroit, Mich.

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Warner Instrument Co., Beloit, Wis.

Cutters, Milling
Adams Co., Dubuque, Iowa.
Becker-Brainard Milling Mach. Co., Hyde Park, Mass.
Boker & Co., Hermann, New York.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Twist Drill Co., Cleveland, O.
Gay & Ward, Inc., Athol, Mass.
Ingersoll Milling Mach. Co., Rockford, Ill.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Hartford, Conn.
Rogers, John M., Boat, Gauge & Drill Works, Gloucester City, N. J.
Standard Tool Co., Cleveland, O.
Whitney Mfg. Co., Hartford, Ct.

Cutting-off Machines
Bignall & Keeler Mfg. Co., Edwardsville, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Burr & Sons, John T., Brooklyn, N. Y.
Davis Mach. Co., W. P., Rochester, N. Y.
Hurlbut-Rogers Mach. Co., South Sudbury, Mass.
Newton Mch. Tool Wks., Philadelphia, Pa.
Nutter, Barnes & Co., Boston, Mass.
Pratt & Whitney Co., Hartford, Conn.
Vandyck Churchill Co., New York.

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Billings & Spencer Co., Hartford, Conn.
Goodell Mfg. Co., Greenfield, Mass.
O. K. Tool Holder Co., Shelton, Conn.
Pratt & Whitney Co., Hartford, Conn.
Western Tool & Mfg. Co., Springfield, O.

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Osgood, J. L., Buffalo, N. Y.
Steel Set Diamond Co., New York.

Dies, Sheet Metal
Bliss Co., E. W., Brooklyn, N. Y.
Gem Mfg. Co., Pittsburg, Pa.
Globe Mach. & Stamping Co., Cleveland, O.
Lutter & Gies, Milwaukee, Wis.
Niagara Mach. & Tool Wks., Buffalo, N. Y.
Perkins Mach. Co., Warren, Mass.
Swaine Co., Fred J., St. Louis, Mo.

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Errington, F. A., New York.
Geometric Tool Co., New Haven, Conn.
Jones & Lamson Mch. Co., Springfield, Vt.
Modern Tool Co., Erie, Pa.
Pratt & Whitney Co., Hartford, Conn.

Dowel Pins
Winkley Co., Hartford, Conn.

Drafting Machines
Universal Drafting Mach. Co., Cleveland, O.

Drawing Boards and Tables
Keuffel & Esser Co., New York.
Rich, J. & G., Philadelphia, Pa.

Drawing Materials
Alteneder & Sons, Theo., Philadelphia, Pa.
Keuffel & Esser Co., New York.

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Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Boynton & Plummer, Worcester, Mass.
Pratt & Whitney Co., Hartford, Conn.
Sloan & Chace Mfg. Co., Newark, N. J.

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American Tool Wks. Co., Cin., O.
Bickford Drill & Tool Co., Cincinnati, O.
Boynton & Plummer, Worcester, Mass.
Dallett Co., Thos. H., Phila. Pa.
Niles-Bement-Pond Co., New York.

Drilling Machines, Multiple Spindle
American Tool Wks. Co., Cin., O.
Baker Bros., Toledo, O.
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Baush Mach. Tool Co., Springfield, Mass.
Bickford Drill & Tool Co., Cincinnati, O.
Dallett Co., Thos. H., Phila., Pa.
Fenn-Sadler Mach. Co., Hartford, Conn.
Flather Planer Co., Mark, Nashua, N. H.
Foote, Burt & Co., Cleveland, O.
Fosdick Mach. Tool Co., Cin., O.
Garvin Mach. Co., New York.
Hardinge Bros., Chicago, Ill.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
McCabe, J. J., New York.
Moline Tool Co., Moline, Ill.
National Auto. Tool Co., Dayton, Ohio.
Newton Machine Tool Works, Philadelphia, Pa.
Niles-Bement-Pond Co., New York.
Norton & Jones Mach. Tool Wks., Plainville, Conn.
Prentiss Tool & Supply Co., New York.

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Coates Clipper Mfg. Co., Worcester, Mass.
Dallett Co., Thos. H., Phila., Pa.
Hisey-Wolf Mch. Co., Cincin., O.
Niles-Bement-Pond Co., New York.

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American Tool Wks. Co., Cin., O.
Baush Mach. Tool Co., Springfield, Mass.
Bickford Drill & Tool Co., Cincinnati, O.
Dreses Mach. Tool Co., Cincin., O.
Fairbanks Co., New York.
Fosdick Mach. Tool Co., Cin., O.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hill, Clarke & Co., Boston, Mass.
McCabe, J. J., New York.
Mueller Mach. Tool Co., Cin., O.
Niles-Bement-Pond Co., New York.
Prentiss Tool & Supply Co., New York.
Ridgway Mach. Tool Co., Ridgway, Pa.
Smith Co., Chas. G., Pittsburg, Pa.
Vandyck Churchill Co., New York.

Drilling Machines, Turret
Niles-Bement-Pond Co., New York.
Quint, A. D., Hartford, Conn.

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Baker Bros., Toledo, O.
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Bertram & Sons Co., Ltd., John, Dundas, Ont., Canada.
Blaisdell & Co., P., Worcester, Mass.
Boynton & Plummer, Worcester, Mass.
Burke Mach. Co., Cleveland, O.
Cincinnati Mach. Tool Co., Cincinnati, O.
Dallett Co., Thos. H., Phila., Pa.
Davis Mach. Co., W. P., Rochester, N. Y.
Fairbanks Co., New York.
Fosdick Mach. Tool Co., Cincinnati, O.
Gould & Eberhardt, Newark, N. J.
Harrington, Son & Co., Edwin, Philadelphia, Pa.

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Knecht Bros. Co., Cincinnati, O.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
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Marshall & Huschart Mchry. Co., Chicago, Ill.
Mechanics Machine Co., Rockford, Ill.
New Haven Mfg. Co., New Haven, Conn.
Niles-Bement-Pond Co., New York.
Norton & Jones Mach. Tool Wks., Plainville, Conn.
Prentiss Tool & Supply Co., New York.
Sibley Machine Tool Co., South Bend, Ind.
Sloan & Chace Mfg. Co., Newark, N. J.
Vandyck Churchill Co., New York.
Whitney Mfg. Co., Hartford, Conn.
Wiley & Russell Mfg. Co., Greenfield, Mass.

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Pratt & Whitney Co., Hartford, Conn.
Slocomb Co., J. T., Providence, R. I.
Standard Tool Co., Cleveland, O.

Drills, Hand
Dallett Co., Thos. H., Phila., Pa.
Hisey-Wolf Mach. Co., Cincin., O.
Niles-Bement-Pond Co., New York.

Drills, Pneumatic
Allen, Jno. F., New York.
Cleveland Pneu. Tool Co., Cleveland, O.
General Pneu. Tool Co., Montour Falls, N. Y.
Ingersoll-Sergeant Drill Co., New York.
International Steam Pump Co., New York.
Niles-Bement-Pond Co. New York.
Rand Drill Co., New York.

Drills, Rail
Foote, Burt & Co., Cleveland, O.
Niles-Bement-Pond Co., New York.

Drills, Ratchet
Billings & Spencer Co., Hartford, Conn.
Parker Co., Chas., Meriden, Conn.
Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland, O.

Drills, Spindle
Three Rivers Tool Co., Three Rivers, Mich.

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Sturtevant Co., B. F., Hyde Park, Mass.

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C & C Electric Co., New York.
Crocker-Wheeler Co., Ampere, N. J.
Eck Dynamo & Motor Works, Belleville, N. J.
Electro Dynamic Co., Bayonne, N. J.
General Electric Co., New York.
Holtzer-Cabot Elec. Co., Brookline, Mass.
Jantz & Leist Elec. Co., Cin., O.
National Elec. Co., Milwaukee, Wis.
Northern Elec. Mfg. Co., Madison, Wis.
Ridgway Dynamo & Engine Co., Ridgway, Pa.
Robbins & Myers Co., Springfield, Ohio.
Roth Bros. & Co., Chicago, Ill.
Sprague Elec. Co., New York.
Stanley Elec. Mfg. Co., Pittsfield, Mass.
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Triumph Elec. Co., Cincin., O.
Westinghouse Electric & Mfg. Co., Pittsburg, Pa.

Electrical Supplies
American Elec. & Controller Co., New York.
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Electric Controller & Supply Co., Cleveland, O.
Electro Dynamic Co., Bayonne, N. J.
General Elec. Co., New York.
Northern Elec. Mfg. Co., Madison, Wis.

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Stanley Elec. Mfg. Co., Pittsfield, Mass.
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Westinghouse Electric & Mfg. Co., Pittsburg, Pa.

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American Tool Wks. Co., Cin., O.
Electric Controller & Supply Co., Cleveland, O.
Hisey-Wolf Mach. Co., Cincin., O.

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Albro-Clem Elevator Co., Philadelphia, Pa.
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Morse, Williams & Co., Phila., Pa.

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Desmond-Stephan Mfg. Co., Urbana, O.
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Dickinson, Thos. L., New York.
Heald Machine Co., Worcester, Mass.
Standard Tool Co., Cleveland, O.

Emery Wheels
See Grinding Wheels.

Enclosures, Tool-room
Merritt & Co., Philadelphia, Pa.

Engineers, Electrical
Crocker-Wheeler Co., Ampere, N. J.

Engines, Automobile
Franklin Mfg. Co., Syracuse, N. Y.
Olds Gasoline Engine Works, Lansing, Mich.

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Abenaque Mach. Wks., Westminster Station, Vt.
Backus Water Motor Co., Newark, N. J.
Columbus Mach. Co., Columbus, O.
Foos Gas Eng. Co. Springfield, O.
Jacobson Mach. & Mfg. Co., Warren, Pa.
Mathews, Hugh, Kansas City, Mo.
Mietz, August, New York.
New Era Gas Engine Co., Dayton, Ohio.
Olds Gasoline Engine Wks., Lansing, Mich.
Pierce-Crouch Engine Co., New Brighton, Pa.
Struthers-Wells Co., Warren, Pa.

Engines, Oil
International Power Vehicle Co., Stamford, Conn.
Mietz, August, New York.

Engines, Steam
American Blower Co., Detroit, Mich.
Buffalo Forge Co., Buffalo, N. Y.
Frick Co., Waynesboro, Pa.
Garden City Fan Co., Chicago, Ill.
Rand Drill Co., New York.
Ridgway Dynamo & Engine Co., Ridgway Pa.
Struthers-Wells Co., Warren, Pa.
Sturtevant Co., B. F., Hyde Park, Mass.

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Gorton Mach. Co., Geo., Racine, Wis.

Exhaust Heads
Burt Mfg. Co., Akron, O.
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Exhibition, Machinery
Philadelphia Bourse, Phila., Pa.

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Badger & Sons Co., E. B., Boston, Mass.

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General Electric Co., New York.
Northern Elec. Mfg. Co., Madison, Wis.
Sprague Elec. Co. New York.
Sturtevant Co., B. F., Hyde Park, Mass.
Westinghouse Elec. & Mfg. Co., Pittsburg, Pa.

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American Blower Co., Detroit, Mich.
Garden City Fan Co., Chicago, Ill.
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BROWN & SHARPE MANUFACTURING CO.,

Providence, R.I., U.S.A.

Grinding Dies. Truing Legs of Jigs and Similar Work.
Finishing Bright, True Surfaces of Small Parts of Machines and Tools.

Only a few of the many operations that may be economically performed on the

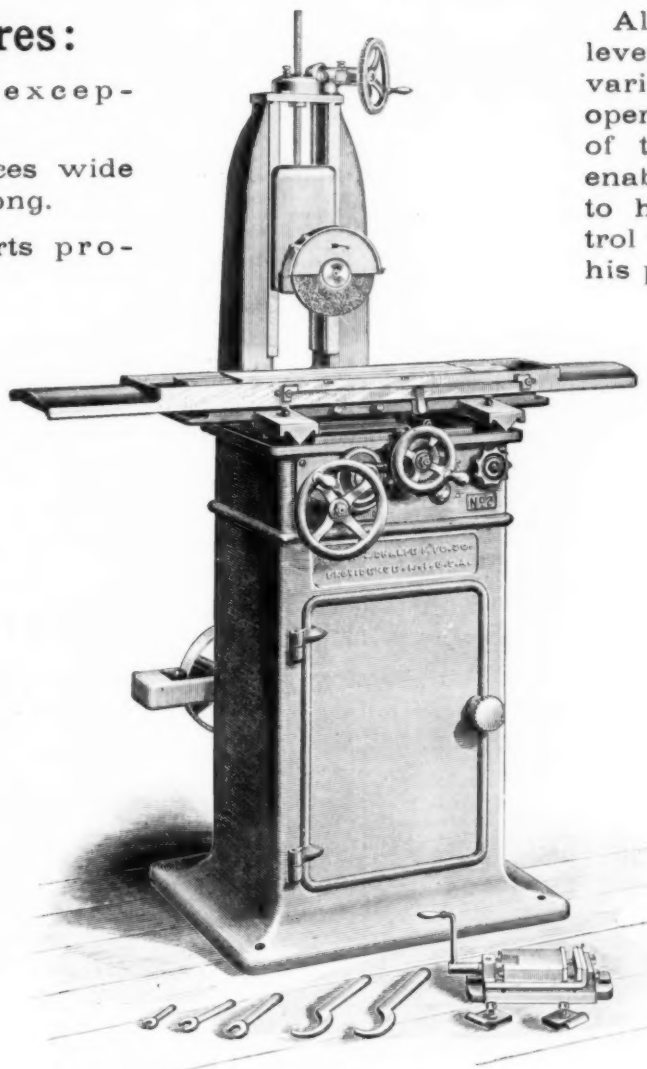
No. 2 Surface Grinding Machine

Some Features:

Construction exceptionally rigid.

Sliding surfaces wide and bearings long.

Working parts protected.



All hand wheels and levers for controlling the various movements operated from the front of the machine, thus enabling the operator to have complete control without changing his position.

Other sizes and styles of Surface Grinding Machines described in catalogue, which is mailed to any address.

Branch Offices

NEW YORK:
136 Liberty Street.

PHILADELPHIA:
654 The Bourse.

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Reichhelm & Co., E. P., New York.

File and Tool Holders
Bowers Mfg. Co., Geo. W., Boston, Mass.

File Cleaners
Miller, Horatio L., Worcester, Mass.

Filing Machines
Cochrane-Bly Mach. Works, Rochester, N. Y.

Filler, Iron
Clark Cast Steel Cement Co., Shelton, Conn.
Felton, Sibley & Co., Phila., Pa.

Filters, Oil
Burt Mfg. Co., Akron, O.
Houghton & Co., E. F., Philadelphia, Pa.

Flexible Shafts
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Stow Mfg. Co., Binghamton, N. Y.

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Buffalo Forge Co., Buffalo, N. Y.
Burke Mach. Co., Cleveland, O.
Ingersoll-Sergeant Drill Co., New York.
Miner & Peck Mfg. Co., New Haven, Conn.
Sturtevant Co., B. F., Hyde Park, Mass.

Forgings, Drop
Billings & Spencer Co., Hartford, Conn.
Clapp Mfg. Co., E. D., Auburn, N. Y.
Page-Storms Drop Forge Co., Springfield, Mass.
Solid Steel Tool & Forge Co., Pittsburg, Pa.
Williams & Co., J. H., Brooklyn, N. Y.
Wyman & Gordon, Worcester, Mass.

Forgings, Hydraulic
Wyman & Gordon, Worcester, Mass.

Forgings, Steel
Heppenstall Forge & Knife Co., Pittsburg, Pa.
Page-Storms Drop Forge Co., Springfield, Mass.
Solid Steel Tool & Forge Co., Pittsburg, Pa.
Wyman & Gordon, Worcester, Mass.

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Hartford Mch. Screw Co., Hartford, Conn.

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Obermayer Co., S., Cincinnati, O.
Paxson Co., J. W., Phila., Pa.
Stevens, F. B., Detroit, Mich.
Sturtevant Co., B. F., Hyde Park, Mass.

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Am. Gas Furnace Co., N. Y. City.
Chicago Flexible Shaft Co., Chicago, Ill.
Westmacott Co., J. M., Providence, R. I.

Furniture, Machine Shop
New Britain Mach. Co., New Britain, Conn.

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Bristol Co., Waterbury, Conn.

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Brown & Sharpe Mfg. Co., Providence, R. I.
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Pratt & Whitney Co., Hartford, Conn.
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Sawyer Tool Mfg. Co., Fitchburg, Mass.
Slocomb Co., J. T., Prov., R. I.
Starrett Co., L. S., Athol, Mass.

Gauges, Steam
American Steam Gauge & Valve Mfg. Co., Boston, Mass.
Lunkenheimer Co. Cincinnati, O.

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Becker-Brainard Milling Mach. Co., Hyde Park Mass.
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Foote Bros. Gear & Mach. Co., Chicago, Ill.
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Gleason Works, Rochester, N. Y.
Gould & Eberhardt Newark, N. J.
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Newton Mach. Tool Wks., Philadelphia, Pa.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Hartford, Conn.
Sloan & Chace Mfg. Co., Newark, N. J.
Whiton Machine Co., D. E., New London, Conn.

Gear Testing Machinery
Gisholt Mach. Co., Madison, Wis.

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Bilgram, Hugo, Philadelphia, Pa.
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Brown & Sharpe Mfg. Co., Providence, R. I.
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Cresson Co., Geo. V., Phila., Pa.
Davis, Rodney, Philadelphia, Pa.
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Eberhardt Bros. Mach. Co., Newark, N. J.
Fawcus Mch. Co., Pittsburg, Pa.
Fellows Gear Shaper Co., Springfield, Vt.
Foote Bros. Gear & Mach. Co., Chicago, Ill.
Ganschow, Wm., Chicago, Ill.
Gleason Works, Rochester, N. Y.
Gould & Eberhardt, Newark, N. J.
Grant Gear Works, Boston, Mass.
Hardinge Bros., Chicago, Ill.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Horsburgh & Scott Co., The, Cleveland, O.
Massey Mach. Co., Watertown, N. Y.
Messmer Mfg. Co., Ferd., St. Louis, Mo.
New Process Raw Hide Co., Syracuse, N. Y.
Nuttall Co., R. D., Pittsburg, Pa.
Patterson, Gottfried & Hunter, Ltd., New York.
Philadelphia Gear Wks., Philadelphia, Pa.
Sawyer Gear Wks., Cleveland, O.
Simonds Mfg. Co., Pittsburg, Pa.
Taylor-Wilson Mfg. Co., Allegheny, Pa.

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Caldwell & Son Co., H. W., Chicago, Ill.
Farrel Fdry. & Mach. Co., Ansonia, Conn.
Franklin Mfg. Co., Syracuse, N. Y.
Greenwald Co., I. & E., Cincin., O.
Taylor-Wilson Mfg. Co., Allegheny, Pa.

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Boston Gear Wks., Boston, Mass.
Chicago Raw Hide Mfg. Co., Chicago, Ill.
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Fawcus Mch. Co., Pittsburg, Pa.
Gould & Eberhardt, Newark, N. J.
Horsburgh & Scott Co., Cleveland, Ohio.
New Process Raw Hide Co., Syracuse, N. Y.
Nuttall Co., R. D., Pittsburg, Pa.

Gears, Worm
Albro-Clem Elevator Co., Philadelphia, Pa.
Boston Gear Wks., Boston, Mass.
Fawcus Mch. Co., Pittsburg, Pa.
Gould & Eberhardt, Newark, N. J.
Grant Gear Works, Boston, Mass.
Morse, Williams & Co., Phila., Pa.
Nuttall Co., R. D., Pittsburg, Pa.
Philadelphia Gear Works, Philadelphia, Pa.
Simonds Mfg. Co., Pittsburg, Pa.
Taylor-Wilson Mfg. Co., Allegheny, Pa.

Graphite
Dixon Crucible Co., Jos., Jersey City, N. J.
Obermayer Co., S., Cincinnati, O.

Grinders, Cutter
Coates Clipper Mfg. Co., Worcester, Mass.
Heald Mch. Co., Worcester, Mass.
Hisey-Wolf Mach. Co., Cincin., O.
Mueller Mch. Tool Co., Cin., O.
Niles-Bement-Pond Co., New York.

Grinders, Cock
Bath Grinder Co., Fitchburg, Mass.
Windsor Mach. Co., Windsor, Vt.

Grinders, Cutter
Automatic Mach. Co., Greenfield, Mass.
Bath Grinder Co., Fitchburg, Mass.
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Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mach. Co., Cincinnati, O.
Garvin Machine Co., New York.
Gould & Eberhardt, Newark, N. J.
Greenfield Mach. Co., Greenfield, Mass.
Heald Mach. Co., Worcester, Mass.
Hisey-Wolf Mach. Co., Cincin., O.
Niles-Bement-Pond Co., New York.
Norton Emery Wheel Co., Worcester, Mass.
Pratt & Whitney Co., Hartford, Conn.
Rivett-Dock Co., Boston, Mass.
Smith Co., Chas. G., Pittsburg, Pa.

Grinders, Disk
Bath Grinder Co., Fitchburg, Mass.
Besly & Co., Chas. H., Chicago, Ill.
Diamond Mach. Co., Provi., R. I.
Heald Machine Co., Worcester, Mass.
Iroquois Mach. Co., New York.
Ney, R. W., Kingston, N. Y.
Ransom Mfg. Co., Oshkosh, Wis.

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Bath Grinder Co., Fitchburg, Mass.
Heald Mch. Co., Worcester, Mass.
Niles-Bement-Pond Co., New York.
Wilmarth & Morman Co., Grand Rapids, Mich.

Grinders, Portable
Heald Machine Co., Worcester, Mass.
Hisey-Wolf Mach. Co., Cincin., O.

Grinders, Tool
Armstrong Bros. Tool Co., Chicago, Ill.
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Bath Grinder Co., Fitchburg, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Diamond Mach. Co., Prov., R. I.
Gisholt Mach. Co., Madison, Wis.
Gould & Eberhardt, Newark, N. J.
Hisey-Wolf Mach. Co., Cincin., O.
Landis Tool Co., Waynesboro, Pa.
Lutter & Gies, Milwaukee, Wis.
Modern Tool Co., Erie, Pa.
Niles-Bement-Pond Co., New York.
Ransom Mfg. Co., Oshkosh, Wis.
Safety Emery Wheel Co., Springfield, O.
Standard Tool Co., Cleveland, O.
Vandyck Churchill Co., New York.
Walker & Co., O. S., Worcester, Mass.
Whitney Mfg. Co., Hartford, Ct.

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Besly & Co., Chas. H., Chicago, Ill.
Blount Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Builders' Iron Foundry, Providence, R. I.
Burke Mach. Co., Cleveland, O.
Coates Clipper Mfg. Co., Worcester, Mass.
Diamond Mach. Co., Prov., R. I.
Fairbanks Co., New York.
Goodell-Pratt Co., Greenfield, Mass.
Greenfield Mach. Co., Greenfield, Mass.
Hill, Clarke & Co., Boston, Mass.
Iroquois Mach. Co., New York.
Landis Tool Co., Waynesboro, Pa.

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Montgomery & Co., New York.
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Northern Elec. Mfg. Co., Madison, Wis.
Norton Emery Wheel Co., Worcester, Mass.
Norton Grinding Co., Worcester, Mass.
Prentiss Tool & Supply Co., New York.
Ransom Mfg. Co., Oshkosh, Wis.
Rivett-Dock Co., Boston, Mass.
Royersford Fdry. & Mach. Co., Royersford, Pa.
Safety Emery Wheel Co., Springfield, O.
Smith Co., Chas. G., Pittsburg, Pa.
Standard Tool Co., Cleveland, O.
Vandyck Churchill Co., New York.
Vitrified Wheel Co., Westfield, Mass.
Walker & Co., O. S., Worcester, Mass.
Wilmarth & Morman Co., Grand Rapids, Mich.

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Diamond Mach. Co., Prov., R. I.
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Houghton & Co., E. F., Philadelphia, Pa.
National Corundum Wheel Co., Buffalo, N. Y.
Niles-Bement-Pond Co., New York.
Norton Emery Wheel Co., Worcester, Mass.
Safety Emery Wheel Co., Springfield, O.
Vitrified Wheel Co., Westfield, Mass.
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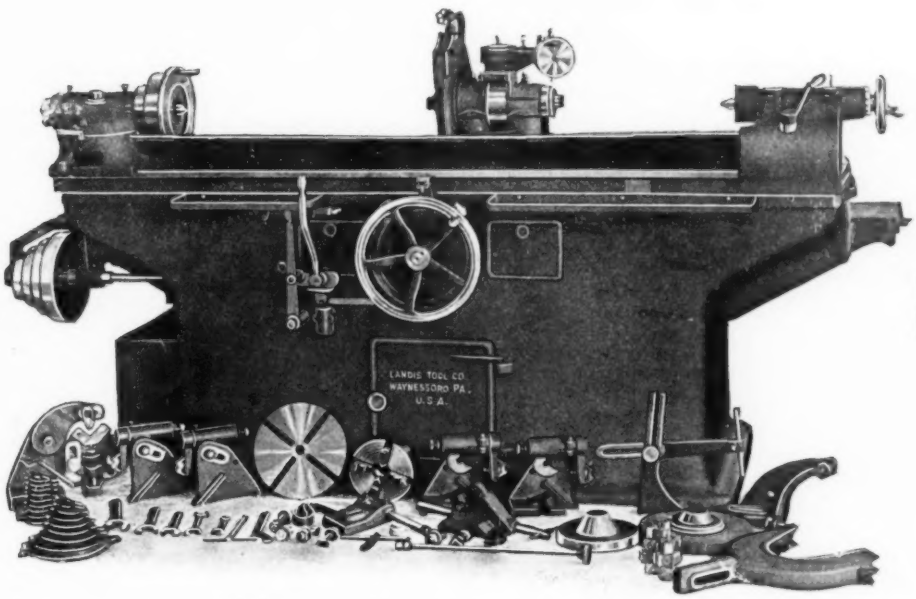

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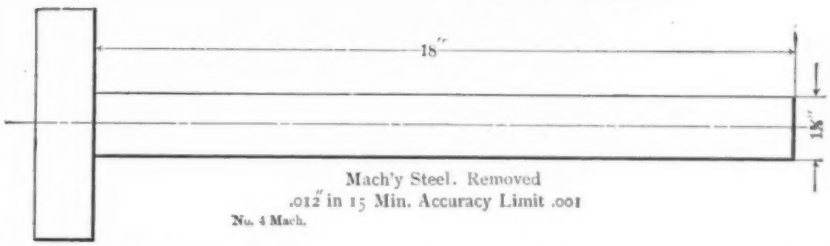

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A Spur-Gear Anglemeter.

BY W. M. WILSON.

In the design of spur gears it is desired to give to the teeth such a form that, as the gears mesh with each other, the relative motion of the two will be the same as that of two cylinders whose diameters have the same ratio one to the other as have the diameters of the two pitch circles. By the aid of kinematics gear teeth can be so designed as to give exactly this relative motion between the gears. However, in the manufacture of gears factors enter which make the form of the teeth of the gears as they come from the shop somewhat different from that developed by kinematics. This variation is quite marked in the case of rough cast gears. Here several errors enter. Because of the difficulty and time required in developing a tooth outline according to kinematics, arcs of circles which approximate the correct outline are used in laying out the gears in the drafting room. From these slightly inaccurate drawings the patternmaker makes the patterns, which are apt to vary slightly in form and the spacing of the teeth from the drawing furnished by the draftsman. These inaccurate patterns then go to the foundry, and from them the molds are made. In making the mold, in order to draw the pattern it is rapped loose, so that the mold is slightly larger than the pattern and still more inaccurate in outline. The casting is poured, and in cooling is warped out of shape because of the cooling stresses leaving a gear with a final error in the form of its teeth made up of several smaller errors, as just enumerated.

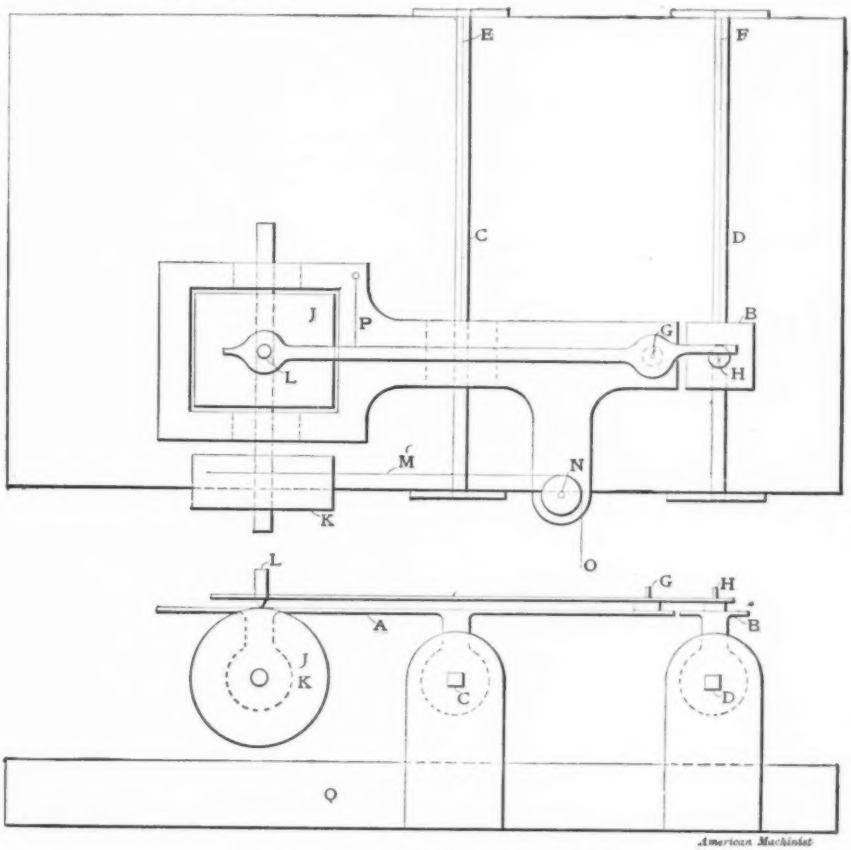


FIG. I. ANGLEMETER FOR SPUR GEARS.

DESCRIPTION OF ANGLEMETER.

A realization of the presence of these errors suggested that a knowledge of the final inaccuracy in the forms of the teeth of rough cast gears would be of interest and perhaps not without value. With this idea in mind, an anglemeter for determining the variation in the angular velocity ratio of gears was designed and built, and is shown in Fig. 1. Referring to this figure, Q is the base upon which the instrument is mounted. Above this base, mounted as shown on the drawing, are two parallel guides C and D of square brass. C carries a carriage A, and D a smaller carriage B. On the carriage A are the drum J and the pulley K, both mounted on the same shaft. A also carries the pointer I and the pulley N. I is fastened to A by means of the pivot G, about which it is free to turn. At the other end of I is the pencil L, which presses upon the drum J. The end of I extends beyond the pivot G and catches on the pin H in the top of the carriage B. The end of the pointer is held in contact with H by means of a rubber elastic P. M is a cord wound around the pulley K and passing over the pulley N, which is fastened to A, and is then fastened to the stationary point O. E is a cord attached to the carriage A, and F one attached to the carriage B. E passes around the shaft of one gear to be tested and F passes around the shaft of the other. The drum J carries a card upon which the variations in the angular velocity ratio of the two gears is to be recorded. In a case where the diameter of one gear does not bear the same ratio to the diameter of the corresponding shaft as does the diameter of the other gear to the diameter of its shaft a reducing motion must be used for either E or F that the average velocity of the points on the two cords will be the same.

USE OF ANGLEMETER.

Having the proper reducing motion connected with either E or F the use of the instrument is as follows: A card is put on the drum J and the two carriages are moved to the back end of the guides and the cords so adjusted that the two carriages are even. With this adjustment the pencil L will be in the middle of the drum J. The cord M is wound tightly around the pulley K. The gears are then turned by hand in such a direction as will cause the cords C and D to pull the carriages along the guides. As the cords move with the same average velocity, the two carriages will be even when they have traveled the length of the guides. If the velocity were constant the carriages would always hold the same relative position to each other and the pencil L would remain at the middle of the drum. As the carriages move and carry N with them while the point O is fixed the cord M turns K and therefore J. Then if the carriages hold the same position relative to each other, as above assumed, the pencil L will draw a straight line around the drum.

Now suppose that the tooth of the driver which is in contact with the tooth of the driven has a raised place on it at the point of contact. For an instant the driven gear will have a velocity greater than the average. Suppose E to be connected with the latter gear, then A will gain slightly on B and the elastic P will move L forward on the drum and change the otherwise straight line so that it will have a curve in it at this point. As soon as the point of contact between the two teeth changes, for an instant the driven gear will have a velocity less than the average. During this time B will regain its former position relative to A and L will again come to the middle of the drum J, or if there is a depression in the tooth at the point of contact L will go beyond the center of J. If all the teeth have the same irregularities in their outlines the otherwise straight line on the card will be made up of a series of waves. The angular variations in the relative positions of the two gears will be a small angle whose arc, on a circle with a diameter equal to the diameter of the shaft, is equal to the change in the

relative positions of *A* and *B* measured in a direction parallel to the guides. This distance is multiplied by the pointer *I* and as multiplied is equal to the distance from the maximum to the minimum of a wave, measured in a direction parallel to the axis of the drum when the card is in place.

In order to determine the amount by which the pointer *I* multiplies any variations in the relative positions of *A* and *B*, a card was placed on *J* and *B* moved so that the pencil *L* was near the end of *J*. *J* was then turned by hand and a straight line was drawn about *J*. Then *B* was moved an eighth of an inch and *J* again turned and another straight line drawn. The distance between these two parallel lines is the distance thru which *L* moves while *B* moves thru an eighth of an inch.

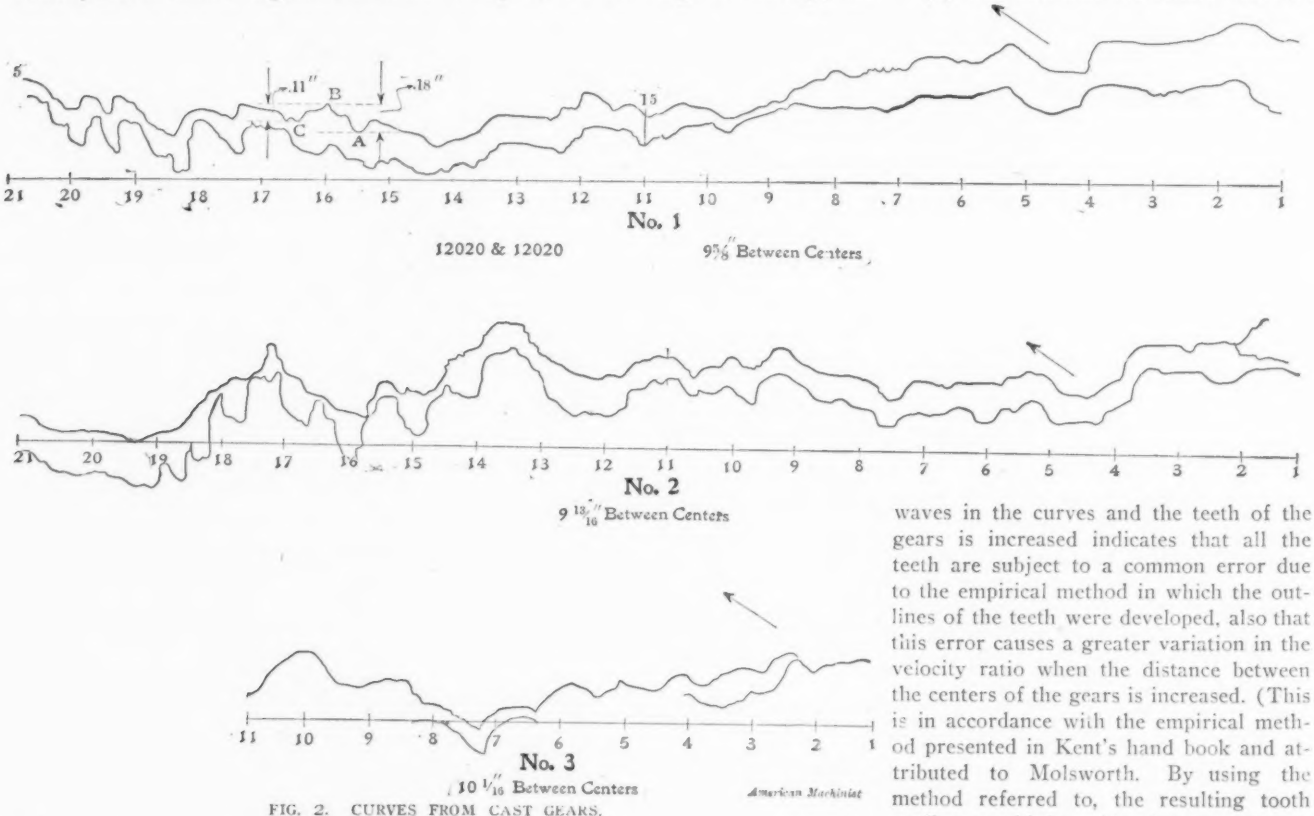


FIG. 2. CURVES FROM CAST GEARS.

From this the amount by which the pointer multiplies was calculated and found to be 9.4.

TEST OF A PAIR OF CAST GEARS.

The instrument was connected to a pair of No. 12020 spur gears, each having a circular pitch of 1½ inches and 20 teeth. Each gear was mounted on a 2 15-16 inch shaft. As the two gears and the two shafts were the same size, no reducing motion was needed. The guides of the instrument were not long enough to allow a complete revolution of the gears, so the teeth were numbered from 1 to 20 and one card drawn for teeth 1 to 11 and another for teeth from 11 to 1. The points on the curves corresponding to the time when these teeth came into contact were marked and then the cards were cut to these marks and pasted end to end as shown in Fig. 2.

The details of the design of this pair of gears were not known, but judging from the shape of the teeth they were modifications of involutes and the outlines of the teeth were probably laid out according to some empirical method in general use in the manufacture of rough cast gears. Before the test the gears had been run long enough for the bearing surface to become smooth.

Cards were taken when the gears were adjusted at different distances apart. If the gears had been true involutes the velocity ratio should be constant and the same for the different distances between the centers. Whether the velocity ratio were constant or not is readily seen from the curves in Fig. 2. Due to the uncertainty of the shrinkage of castings, the diameter of the gears was not exactly equal to the computed diameter but a trifle greater. Judging from the clearance at the ends of the teeth the proper distance between the centers of the gears was 9⅝ inches. Card 1, Fig. 2, gives a curve corresponding to this distance between centers. Two curves were drawn before the card was removed and the ability of the instrument to duplicate a curve is considered as evidence of its accuracy. It is seen from the curve that the velocity ratio instead of being constant is quite erratic in its variations. While in general the variations in the curve are not related to each other in any way, yet for a portion of the card at least the waves in the curve correspond roughly with the teeth on the gears. This is especially true of the portion of the curve corresponding to the teeth from 11 to 20. The curves on card No. 2 were drawn when the distance between centers was 9 13-16 inches. In this case there is a more marked relation between the waves in the curves and the teeth on the gear than in the former case. For card 3 the distance between centers was 10 1-16 inches and the regularity of the waves is still more marked. In this case the card was taken for half a revolution only.

For all the cards the arrows above the different curves indicate the general direction of the tangent to the curves which give the angular acceleration of the driven as compared with the driver.

From the curves shown the following conclusions have been drawn relative to the forms of the teeth:

(1) The fact that the relation between waves in the curves and the teeth of the gears is increased indicates that all the teeth are subject to a common error due to the empirical method in which the outlines of the teeth were developed, also that this error causes a greater variation in the velocity ratio when the distance between the centers of the gears is increased. (This is in accordance with the empirical method presented in Kent's hand book and attributed to Molsworth. By using the method referred to, the resulting tooth outline would be wider below and narrower above the pitch circle than true involute teeth. When the distance between centers is normal these errors annul each other almost completely, but as the distance is increased the result of the errors is more apparent.)

(2) Irregularities in the curves indicate errors peculiar to the individual teeth, which evidently are involved in the progress of patternmaking and molding.

(3) A shifting of the general vertical position of the curves on the cards, as shown at teeth 4 and 14, indicate errors in the spacing of the teeth.

An effort has been made to analyze the curve in card 1. The portion of the curve *A B C* has been chosen as being a wave whose relation to an individual tooth is the most evident. The abscissa *A C* represents the angular space occupied by one tooth on the gear, and *A B* and *B C* each

represent one-half of that angular space. The ordinate between A and B measures .18 inch, and that between B and C measures .11 inch. Dividing by 9.4, the constant for the instrument, it is found that the driven gear gains on the driver by an angle whose arc measured on the circumference of the shaft is .18 divided by 9.4 equals .019 inch, while the gear turns thru an angle equal to

$$\frac{360}{20} \times \tfrac{1}{2} = 9 \text{ degrees.}$$

An angle whose tangent is

$$\frac{.019}{1.46885\,(\text{radius of shaft})}$$ is 45 minutes.

Computing in the same manner the angle corresponding to the ordinate $B\,C$ is found to be 30 minutes. That is, while the tooth No. 16 is in action the driven gains relative to the driver by an angle of 45 minutes while the latter is turning thru an angle of 9 degrees, and then loses by an amount of 30 minutes in the same space. An error of .019 inch measured on the circumference of the shaft corresponds to .06 inch measured on the pitch circle.

TEST OF A SPECIAL PAIR OF GEARS.

The second pair of gears to which the instrument was attached consisted of a No. 12016 pinion having 1½ inches circular pitch and 16 teeth and a No. 12050 gear having 50 teeth. The gears were designed to mesh properly when the distance between centers varies by an amount equal to ½ inch (a full description of these gears was given at page 1712, Vol. 26). The shrinkage of the casting was not as much as was expected, so that the normal distance between centers is .20 inch more than the sum of the computed radii. If the gears were true involutes the velocity ratio should be constant when the distance between centers of the gears varies from 15.7 to 16.2 inches.

The outlines of the teeth of the gears are involutes having an angle of obliquity of 23½ degrees when the distance between centers of the gears is normal. The mold for No. 12016 was made from a pattern, while for No. 12050 it was made from a tooth-block as used in a Walker gear-molding machine. The pattern and tooth-block were both made from drawings laid out in the drafting room. The tooth outlines for these drawings were developed according to kinematics, so that for the exception of any small error which the patternmaker might make, the teeth on the pattern and tooth-blocks are correct involutes.

How near the castings approached to involute gears is shown by the curves in Fig. 3. As the two gears were not of the same size, it was necessary in taking the cards to use some means of making the average velocity of the two carriages of the instrument the same. To do this the hub of the gear was turned to a smooth surface and the end of the shaft of the pinion was turned down until its diameter bore the same ratio to the diameter of the hub of the gear that the diameter of the pitch circle of the pinion bore to the diameter of the pitch circle of the gear. This gave a rigid and accurate reducing motion. The method of taking the cards was the same as for the other pair of gears except that a curve for a complete revolution of the pinion was obtained upon a single card. The distance between centers of the gears for the different cards is as indicated in the figure. Cards 1, 2 and 3 cover the range of variation in the distance between centers for which the gears were designed. From these curves it is seen that there are no waves on the curves corresponding to the individual teeth, the curves for the most part are smooth, and are practically the same for the different distances between centers of the gears. For card 4 the distance between centers was made 16.45 inches, or .75 inch more than the least distance between centers at which the gears were supposed to run. The remarks made in regard to curves 1, 2 and 3 apply equally well to this curve also. For cards 5 and 6 the distance between centers was so great that the point of contact of the teeth did not follow the line of obliquity throughout the angle of contact but lay outside of this line for the latter portion of the period of action of the teeth. This is clearly brought out in the forms of the curves in which waves corresponding to the individual teeth are quite evident.

It will be noticed that for all of the curves for the second pair of gears there is an extended wave near the middle of the card and also near each end, so that if several cards were placed end to end so as to form a continuous curve there would be two complete waves on this curve per revolution of the pinion. This indicates that the pinion instead of being exactly round is oval in form. This deformation can be traced to the molder in the foundry who in order to draw the pattern raps it loose from the sand and unless great care is taken increases the diameter more in one direction than in the other. The wave in the curve is traced to the pinion instead of to the gear because the spacing of the teeth for the gear was done by means of a molding machine and any errors which might occur would be peculiar to the individual teeth instead of being common to a group of teeth and gradually increasing and decreasing from zero up to a maximum and then back again to zero, as indicated on the cards.

From the curves in Fig. 3 the following conclusions are drawn relative to this pair of gears:

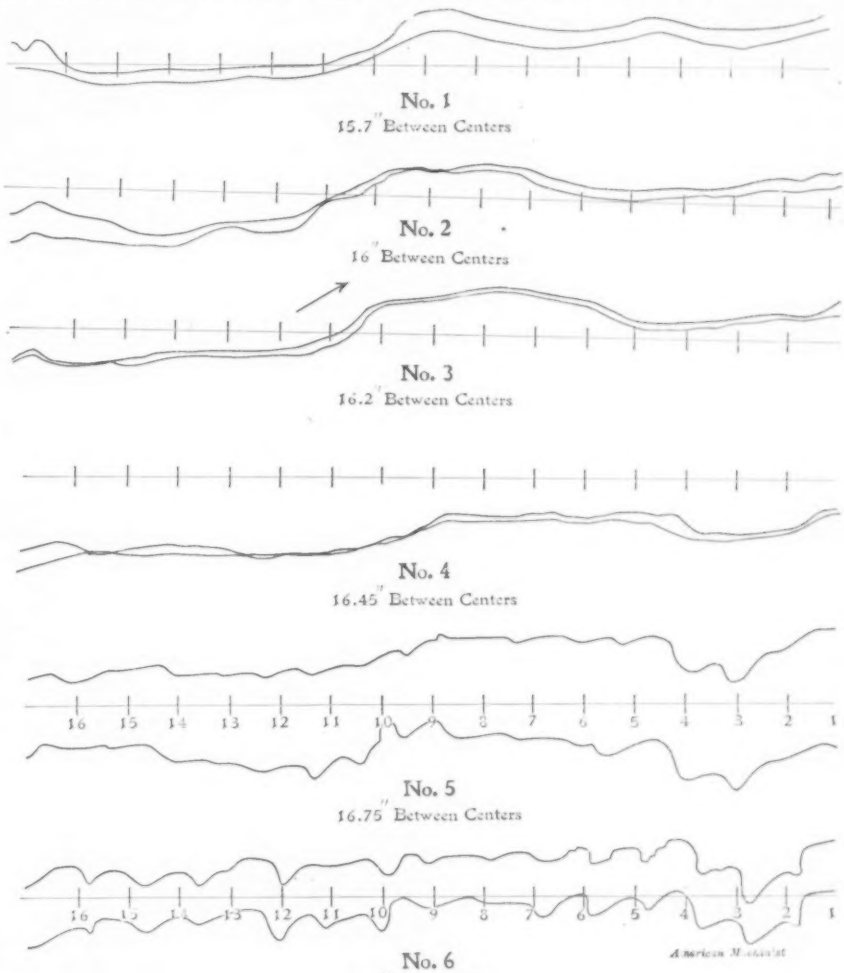

No. 1
15.7" Between Centers
No. 2
16" Between Centers
No. 3
16.2" Between Centers
No. 4
16.45" Between Centers
16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1
No. 5
16.75" Between Centers
16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1
No. 6
16.92" Between Centers

FIG. 3. CURVES FROM SPECIAL GEARS.

1. The outlines of the individual teeth are true involutes.

2. The spacing of the individual teeth on both the gear and the pinion is accurate.

3. The pinion is slightly oval in form.

4. For the gears used the angular velocity ratio is constant thru a range in the variations in the distance between centers equal to .75 inch.

GENERAL CONCLUSIONS.

If one would be allowed to draw conclusions from the tests of two pairs of gears only the following statement might be made in regard to the errors in the form of the teeth of rough cast gears:

1. Of all the errors the greatest is due to the laying out of the teeth in the drafting room.

2. Given an accurate drawing the patternmaker can make a pattern very accurate in form.

3. In using the patterns the molder is apt to make the mold slightly oval in form, but in using a molding machine the error induced in the foundry is very small.

4. The surfaces of the teeth of cast gears are so smooth as not to affect the angular velocity ratio.

The difference in the appearance of the curves for the two pair of gears is very much in accordance with the manner in which they meshed, the second pair running with very much less noise than the first pair. At a speed of 250 revolutions per minute the first pair almost threatened to shake the testing machine to pieces while at the same speed the second pair ran with but little vibration.

It might be said that the patterns for the second pair of gears were completed before there had been any thought of subjecting the gears to a test, which fact eliminates the possibility of unusual care having been taken in making the patterns.

I wish to take this opportunity of thanking the manufacturers, H. W. Caldwell & Son Company, of Chicago, for furnishing this second pair of gears for test purposes.

From statistics printed in the *Advertiser*, Giessen, Germany, the following statement shows the average daily wage of an adult laborer permanently employed, winter and summer, at that place at specified periods during the last seventy-five years: In 1830, 13.5 cents; 1840, 16.8 cents; 1850, 20.4 cents; 1860, 26.4 cents; 1870, 33.6 cents; 1880, 48 cents; 1890, 54 cents; 1900, 60 cents; 1905, 64.8 cents. It thus appears that the laborer's wage has increased fivefold since 1830. It should be borne in mind that the necessaries of life, house rent, etc., have also greatly increased during the seventy-five years under consideration.

The London & South-Western Railway Company has lost a locomotive. One possible explanation is that the engine may have been switched on to some branch line in Cornwall or Devon and its existence forgotten. Another theory is that a new number may have been given it.

Shop Tools and Devices—I.

BY F. J. LE CARD.

The accompanying sketches show some shop tools and appliances which have been found handy for the purposes stated.

DEVICE FOR HOLDING SMALL WORK IN THE LATHE OR MILLER.

Fig. 1 show a convenient means of holding work like piece *a* while milling a key slot, squaring the end or taking other cuts in the milling machine or lathe. Having such work to handle myself, I took a piece of round brass rod *b*, opened one end to fit *a*, then with a screw *c* at the other end locked the head or cap on the piece against the seat formed at the bottom of the large opening. Cut back a common machine screw if there are many pieces to work on to put in and remove the work quickly; and cut away *b* at the outer end for observation.

A JOB OF SCRAPING.

In Fig. 2 is given a section of a regular slide or grinding rest with parts *d* and *e* connected in the usual way, but used for another purpose. Two screws and nuts like *f*, the nut moving in a circular slot, and entered by an opening below, were to be superseded by a close-fitting piece like the nut fixed to *d* and allowing *d* to turn on *e* without binding. The disk *g* with teeth cut on the top side and pinned at *h* to block *i* was used to scrape the upper part of the wide portion of the slot. The piece *i* running in the narrow part of the T-slot kept the scraper in position to cut; and the screw *j* drew it to the work until a parallel slot was made by rotating *d* on *e*. It made a very nice surface, too.

A NURLED HOLDER FOR HOLLOW MILLS, CENTER REAMERS, ETC.

An all-around nurled holder for numerous uses such as holding the center reamer, Fig. 3, and hollow mills for sizing ordinary screw bodies with or without shoulders where screw machine work would be inconvenient, is shown in Fig. 4.

I keep for my own use a number of hollow mills like *k* for the common screw sizes under ¼ inch. I make them about 1¼ inches long and ⅜ inch and 5-16 inch outside diameters. I clear the back of the mill with a drill larger than the body of the screw, and give the sizing hole clearance with a Stubs taper broach. It is only necessary to point the work for starting the hollow mill; it cuts very smoothly and to size, and is very handy for making and fitting shoulder screws. By fitting I mean taking off the shoulder on the screw body or under the head to lengthen or shorten the body.

Larger mills than ¼ inch are used by putting them on a 5-16 or ⅜-inch rod held in the holder. The holes bored in the holder are countersunk for use on the lathe center. A small size Almond or Beach chuck is especially handy here, either for holding small drills on the center or as a hand vise.

I mount the chuck with 5-16 inch shank, as this will enter the medium size drill chuck so commonly used in small upright drill presses. It may be safe to say that four out of five of the latter are disabled for holding very small drills; and a true chuck like *l* put in the larger chuck helps out wonderfully.

A THREAD DIE HOLDER.

Fig. 5 is a holder for round dies to be used in the lathe. The hollow rod *m* for guiding the die can have a straight or taper shank for a tailstock chuck or spindle. The nurled shell *n* slides on *m* and starts and keeps the die straight on the work. It holds a ⅝ round die and the adapter *o*, which can be used on either end, holds 1-inch and 13-16 inch dies. The 7-16 inch jeweler's size dies can be used with a bushing in one of the openings.

A HOLDER FOR USE IN GRINDING TAPS.

A holder for grinding small, three-sided taps is shown in Fig. 6. It is six-sided, and by grooving three sides confusion is avoided in using each side. Small taps for watch work used to be made in this way. After grinding the three sides of the tap, the cutting end can be backed off by using the three grooved sides of the holder. It is used, as shown, on a lathe table rest. Used on two opposite sides it is convenient for grinding small chisels, flat drills, etc., on an emery wheel. A four-sided holder is useful for other shapes and a chuck or a socket for receiving the work can be used.

SETTING ROUND WORK FOR BORING TRANSVERSELY IN THE LATHE.

Fig. 7 is a lathe appliance of my own importation for use when holes are to be bored or drilled transversely in a rod or shaft.

Having a center-punch mark on the work for the location of hole, bring the center *p* against the piece and with V-center *q* push the rod up against the V-blocks *r* and hold in place until clamped by straps *s* or *t*.

A GRADUATING TOOL AND METHOD OF SETTING IT.

A cheap, always ready graduating tool that can be used most anywhere for ordinary work is shown in Fig. 8. It can be improved upon by a better shaped cutting tool, if needed. The auxiliary sketch shows at *u* how I set the point centrally: I put a ⅛-inch pin in one chuck and the holder *v* in the other, one chuck being in the bench lathe, and the other in the milling attachment. Then the pin *u* in the place of *w* locates *v* in its chuck.

TESTING LATHE CENTERS.

To see if lathe centers are opposite, have a sharp, accurately ground center in the tailstock, and with this, everything being firmly in place, prick a piece of stock held in the chuck, or any way in the head of the lathe. Then with an indicator, as in Fig. 9, test the alinement by turning the

spindle and seeing if the center mark runs true.

A PUNCH AND DIE KINK.

In making punches and dies I line up the round ones by leaving a point on the punch, as in Fig. 10, to be ground off afterward. I make this point 60 degrees, like a lathe center, then with this point in a female center and the other end on a male center (the hole for the screw being countersunk) I grind the punch all over to finish size.

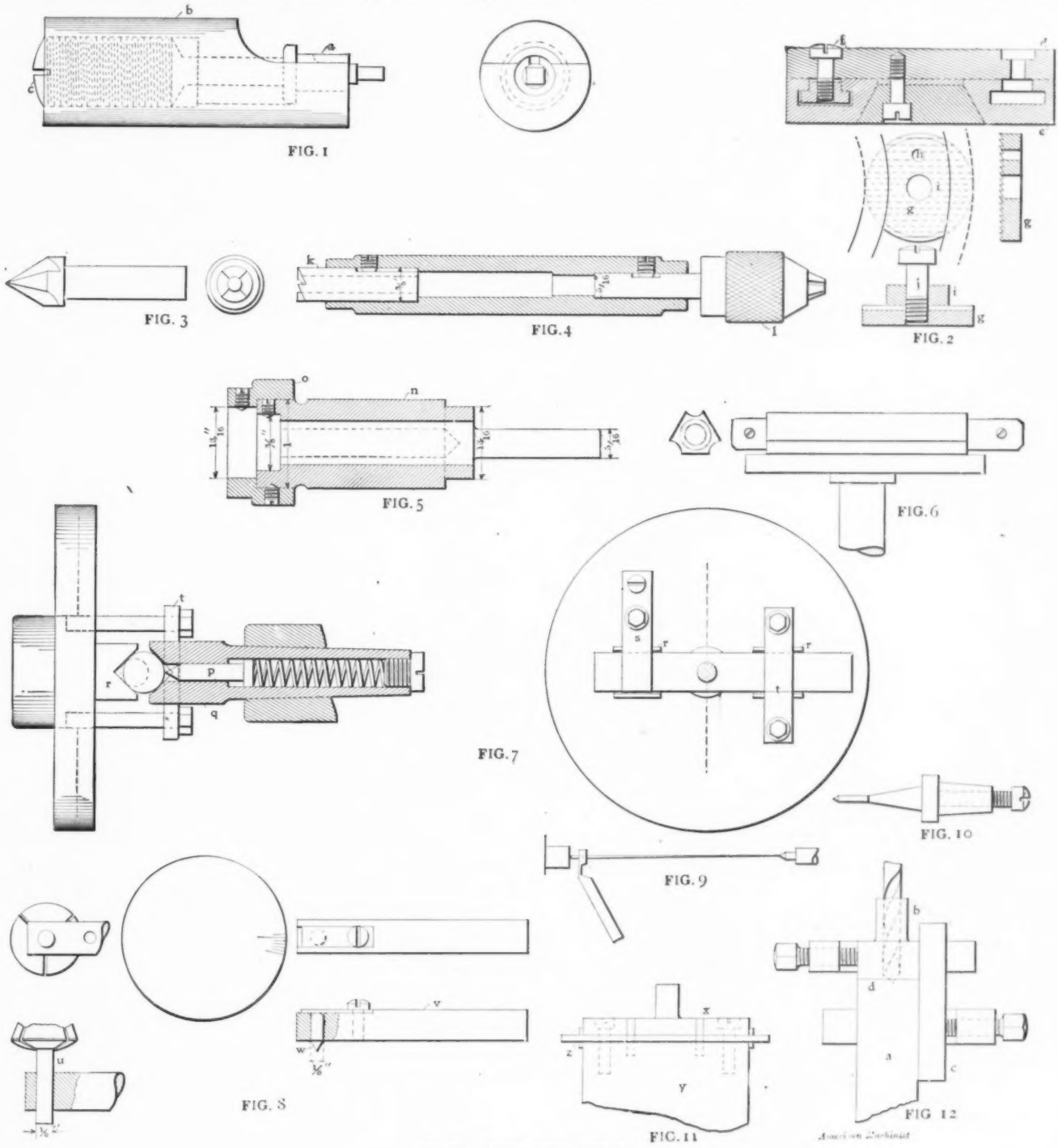
When the punch and die are alined in the sub-press or otherwise, I mark the soft die blank with the punch point, and swing up and bore the die in the lathe from this mark. If necessary to grind out the holes in the die after hardening, I plug them with brass or soft steel, and re-mark as before, and swing up, drive the plug out and grind true.

This lines up the die right in position at the working end of the punch and dispenses with any long-distance reaching or the making of any extra tools for the purpose.

TRANSFER OPERATIONS.

Fig. 11 illustrates a transfer process in which it is intended to place another piece like *x* on *y*, using the same holes in *y*. The hubs on *x* and the new piece prevent the use of *x* for transferring accurately. So we transfer thru *x* on to a middle plate *z*, using pins or scribed lines to locate endwise. Then we use the plate *z* to transfer back on to the new piece, the duplicate of *x*.

Another simple method of holding a seemingly hard piece to transfer from is represented in Fig. 12. Let *a* be a long piece—as a slide-rest—to which the piece *b* is to be secured. Both pieces are flush on all the edges, and *a* is too long to admit of clamping directly on to *b*, which would also interfere with the holes. So plate *c* is clamped on to *a* and *b* to *c*, the ends at *d* being flush, and four clamps used instead of the two shown.



HANDY TOOLS AND DEVICES.

The Layout and Construction of Cams—IV.

BY CHARLES F. SMITH.

LAYING OUT PERIFERY CAMS.

The laying out of a perifery cam cannot be done quite so directly as that of a face cam, as the layout must be a development and not a projection drawing. After laying out the profile it is transferred to a sheet zink templet in the same manner as a face cam which is then wrapped around the former on which the outline is scribed as in the case of a face cam. To provide for any minute discrepancy between the length of the templet and the circumference of the former, it is important that the place selected for the joint in the templet shall be within a straight part of the groove. Were it within an inclined part the result of such a discrepancy would be a jog when the templet is wrapped around the former, but by selecting a straight portion this is avoided.

To illustrate the laying out of a perifery cam, cam 5 *winders wind link* of the chart has been selected and is shown in Fig. 22. To make the horizontal measurements on this drawing, it is necessary to translate the positions given in the chart by degrees into inches of circumference and, dividing the entire circumference of the chart by the number of five degree divisions, we find that for each one of them we must measure .785 inch when laying out the cams. The division point of the templet in this case is selected 4 inches to the left of the root of the curve of the chart, which nearly, tho not exactly, coincides with the 180-degree line of the chart.

The chart informs us that the movement of the roller takes place during twelve 5-degree intervals and $12 \times .785 = 9.42$ inches, or nearly enough for the present purpose, 9⅜ inches. It should be remarked that when evening up decimal into binary divisions the next smaller division should in general be selected, as the result is to slightly quicken the action which cannot in general lead to conflict. Laying down 9⅜ inches on the base line and measuring vertically the movement of the roller, 3½ inches, as shown on the chart, we have the rectangle within which the curve is to be laid down and to find it we have only to follow the method given in Fig. 5. The throw circle is drawn and divided as before. Arcs *a b* and *c d* are drawn thru the

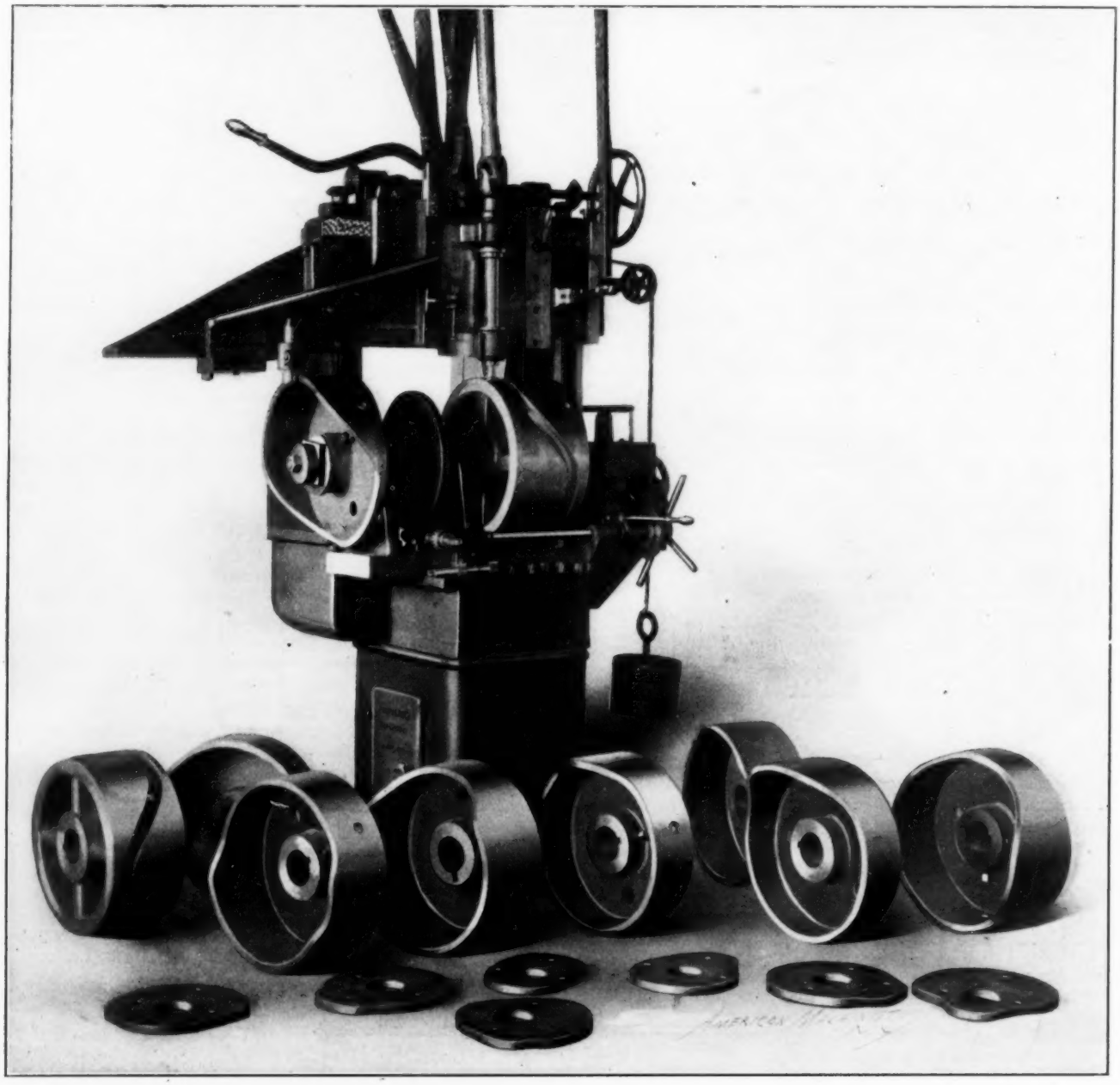


FIG. 24. MILLING A PERIFERY CAM.

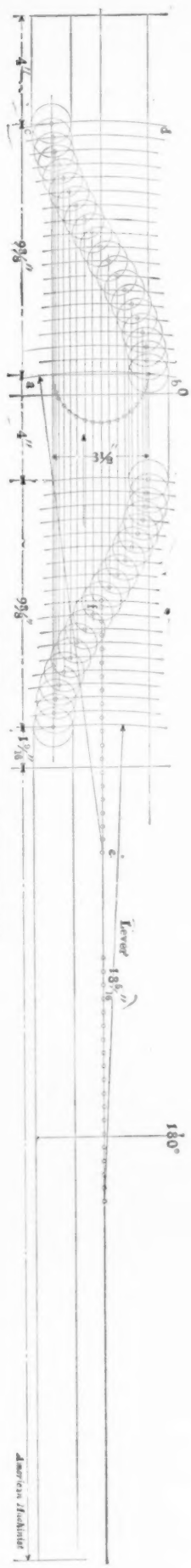


FIG. 22. LAYING OUT A PERIFERY CAM.

corners of the rectangle with the length of the radius arm as a center giving the centers *e f*. The line *e f* is then divided and the intermediate arcs are drawn, the intersections of which with the parallels thru the divisions of the throw circle give points on the pitch line of the groove from which circles with a radius equal to that of the roller define the groove. The dwell before the return movement takes place is then laid down and the return curve is drawn in the same way.

The displacement of the true zero from that assumed when laying out the chart is to be found, as was that of the face cam, by measuring on the general drawing the angular distance from the horizontal center line of the cam shaft to the position of the roller and the position so found is then marked on the drawing and on the chart.

Fig. 23 is given without detailed description to illustrate the laying out of a cam which makes the movement in one direction in two steps and in the return direction in one. It shows No. 14 *dial slide cam* of the chart. The diameter of the return throw circle will be seen to be equal to the sum of the diameters of the acting movement throw circles.

LOCATING THE ZERO OF THE FORMER.

The zink templet is laid out from the drawing in a manner not essentially different from that used with face cams, the zero being properly marked. Since, however, the former and cam of the perifery style are mounted on the same arbor when milling the groove, a different method is used to make their zeros agree. The pinholes drilled thru face cam and former serve to secure this agreement with face cams, but with the perifery style keyseats in former, blank and arbor serve the same purpose.

To secure the agreement of the keyseats and zeros I keyseat the formers before they are scribed and mount them in the machine with keys in place alongside their cam blanks when the latter are rigged up for marking their zeros and then mark the zero on both blank and former at the same time. The parts being removed the templet is then wrapped on the former blank, the zeros being made to coincide, and the former has the outline of the templet scribed upon it. After dressing the former to the scribed outline it is then placed on the keyseated milling machine arbor with the cam blank and both are keyed thereto, the result being of necessity a perfect agreement between the zeros of former and blank.

The milling of the groove in the cam is shown in Fig. 24. It is done in the same machine as the milling of the face cam, but with a different fixture, and no detailed description of it is necessary. About the base of the machine are grouped the formers for all of the cams, both face and perifery, which belong to the chain machine.

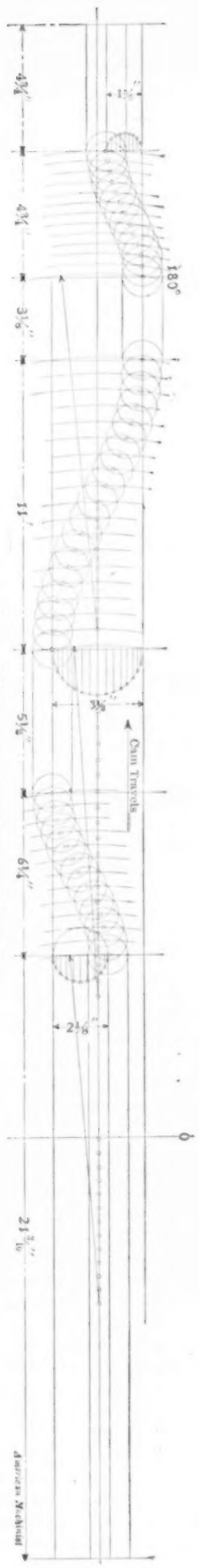


FIG. 23. LAYING OUT A TWO-STEP PERIFERY CAM.

RADIUS MILLING ATTACHMENT.

While the style of fixture shown in Fig. 24 is the one commonly used, and while it is sufficiently accurate for most purposes it is not correct in principle and in some cases, especially when the radius arm of the roller is short, another form of fixture becomes necessary. The error due to the fixture shown in Fig. 24 is shown in Fig 25, from which it will be seen that at all points except *a* and *b* the roller is not directly above the center line of the shaft and of course the groove should, by rights, be milled to correspond. The fixture shown gives a groove which looks directly toward the center line at all points and this leads to a tendency for the roller to cramp in the groove.

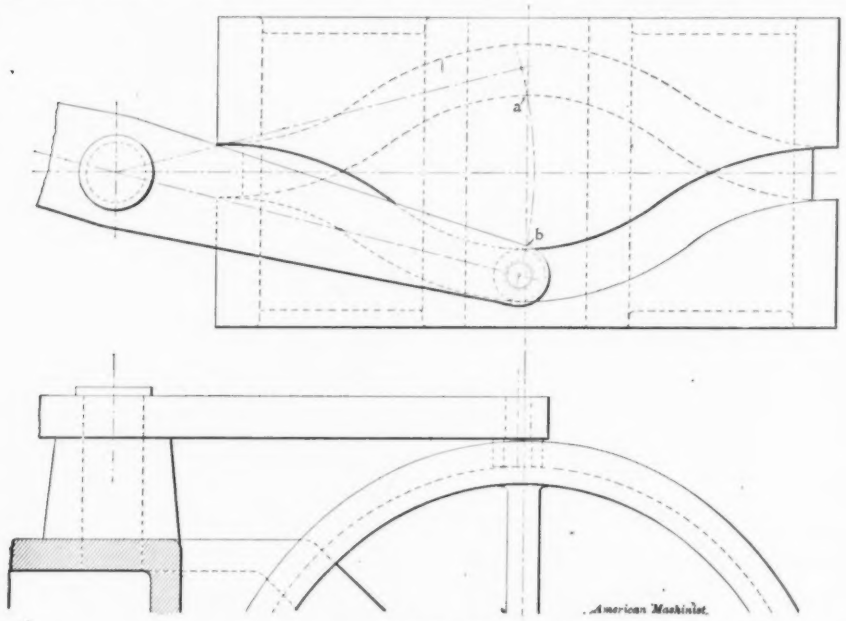


FIG. 25. ARC OF MOTION PROPERLY DIVIDED.

Fig. 26 shows a radius milling fixture designed on correct principles, tho not for show purposes, as it was gotten up hastily for a hurry job. The former is shown at the right and the cam being milled at the left. Roller and cutter, which in this case are conical, are mounted on radius arms of which the length is equal to the arm on which the roller is to be mounted in the complete machine and the cutter is connected to the milling machine spindle by a universal jointed and telescopic shaft. The chain and weight for maintaining contact are not shown.

POINTS TO BE OBSERVED WITH PERIFERY CAMS.

Another feature of perifery cams which should not be overlooked is the dividing up of the arc of motion which also is shown in Fig. 25. The lever is here laid out, as it should be, with the arc of motion divided by both horizontal and vertical center lines.

Many designers make and recommend conical rollers for perifery cams, the rollers being laid out as are the pitch lines of bevel gears. This form of roller has, however, an end thrust which cramps the lever and leads to wear under heavy loads, and hence I prefer and commonly use straight rolls. Of course their rolling action on the side of the groove is not theoretically perfect, and to reduce this I make the rollers shorter than do many designers. My rollers have a length not much in excess of half their diameter.

Another matter which is of greater importance than would at first sight be thought, is to have the cam run away from the fulcrum of the lever instead of toward it, as the action is much the smoother with the former arrangement.

Underpaid Foreign Postage.

Consular Reports again calls attention to the carelessness, or otherwise, of American correspondents as to adequate postage upon mail matter sent to foreign countries. The following instance is reported from Sweden:

"Upon the request for catalogs and quotations a firm in the United States sent us a heavy parcel of printed matter, the cover with a 2-cent stamp on it. The underpaid postage amounted to 5.64 kroner (about $1.50). We thought this rather too much and returned the lot."

Another suggestive instance is as follows:

"Some time ago we received a letter from a correspondent in Liverpool enclosing the cover of a letter on which full postage had not been prepaid, stating that he simply called our attention to it because the same mistake had occurred several times before, and suggested that we give our mailing clerk instructions to be more careful. We answered, apologizing for the mistake, and promised to do what we could to prevent its recurrence. In due course we received another letter calling our attention to the fact that even this letter containing our apology had been short paid in spite of all our precautions."

Another fact often called to the attention of business men by consular officers, is the importance of putting extra postage into letters asking for information. Stamps of the country to which the letters are sent need not be used. United States stamps are, as a rule, preferred, for the foreigners often have use for them when asking for information here. The whole question of foreign postage is important. Too much attention cannot be given to it. At times a great deal depends upon it; more than merchants and manufacturers may think.

American Machine Tools in Germany.

Consul-General Guenther, of Frankfort, Germany, reports that at a recent session at Hanover of the executive committee of the Association of Machine Tool Manufacturers of Germany, it was stated that the existing strike among the coal miners throws an unfavorable light on the social and political condjtions of the country; that the new commercial treaties negotiated with Russia and Austria-Hungary are not advantageous, and that these countries have greatly advanced their tariff rates on German machine tools. In view of the diminished exports of the latter to European countries, it was urged that the German machine tool manufacturers all the more strongly demand efficient tariff protection against the United States, whose exports to Germany grow at a highly alarming rate. The imports of American machine tools by Germany advanced from 698 metric tons in 1902 to 2,079 tons in 1904.

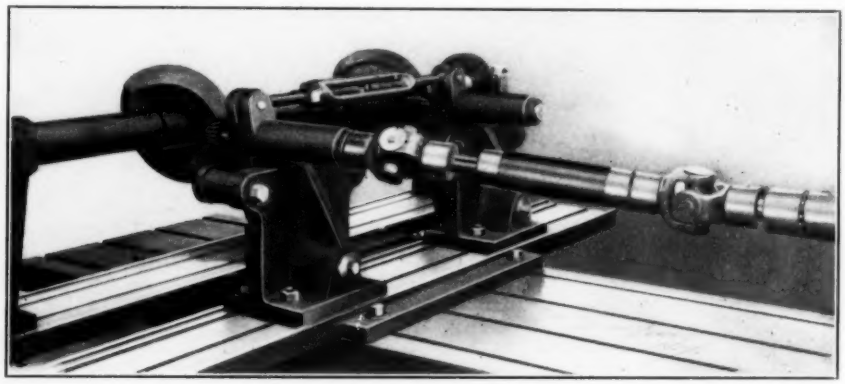


FIG. 26. RADIUS MILLING FIXTURE.

Bevel Gear Formulas.

BY JOHN EDGAR.

In the following it is the intention to give a systematic treatment of the solution of bevel gear problems. It might be well to say that it has been my experience that a graphical method does not give sufficiently accurate results where nice running gears are expected, and that no two men can lay out a pair of gears and, by scaling the drawing, get results that will stand comparison. Therefore the real object sought in this article is the compilation of a set of formulas that will answer for any case that may come up and place them in a systematic arrangement such as will be found in Tables 1 and 2, which will be found useful for reference.

GEARS WITH SHAFTS AT RIGHT ANGLES.

As is generally the case, it will be assumed that we know the diameters of the gears, which we will represent by D_1 and D_2 for pinion and gear respectively. If

		PINION.		GEAR.
Diametral Pitch	P		P	
Number of Teeth	N_1	$D_1 \times P$	N_2	$D_2 \times P$
Pitch Diameter	D_1	$N_1 \div P$	D_2	$N_2 \div P$
Outside Diameter	OD_1	$D_1 + d_1$	OD_2	$D_2 + d_2$
Diameter Increase*	d_1	$\frac{2 \cos. \phi}{P}$	d_2	$\frac{2 \sin. \phi}{P}$
Center Angle	ϕ	$\tan. \phi = \frac{N_1}{N_2}$	θ	$90 - \phi$
Tooth Angle = Angle Increment	δ	$\tan. \delta = \frac{2 \sin. \phi}{N_1}$	δ	
Face Angle		$\theta + \delta$		$\phi + \delta$
Cutting Angle		$\phi - \delta$		$\theta - \delta$
No. of Teeth for which to select Cutter	N'	$\frac{N_1}{\cos. \phi}$	N''	$\frac{N_2}{\sin. \phi}$
Backing Increment*	B_1	$\frac{\sin. \phi}{P}$	B_2	$\frac{\cos. \phi}{P}$

* Note that backing increment is the same as one-half the diameter increase of the mating gear.

TABLE 1. FORMULAS FOR BEVEL GEAR PROBLEMS—SHAFTS AT 90 DEGREES.

		PINION.		GEAR.
Diametral Pitch	P		P	
Number of Teeth	N_1	$D_1 \times P$	N_2	$D_2 \times P$
Pitch Diameter	D_1	$N_1 \div P$	D_2	$N_2 \div P$
Outside Diameter	OD_1	$D_1 + d_1$	OD_2	$D_2 + d_2$
Diameter Increase	d_1	$\frac{2 \cos. \phi}{P}$	d_2	$\frac{2 \cos. \theta}{P}$
Center Angle, Shafts less than 90°	ϕ	$\tan. \phi = \frac{\sin. O}{\frac{N_2}{N_1} + \cos. O}$	θ	$O - \phi$
Center Angle, Shafts greater than 90°	ϕ	$\tan. \phi = \frac{\cos. I'}{\frac{N_2}{N_1} - \sin. I'}$	θ	$O_1 - \phi$
Center Angle of Shafts	O			
	I'	$O - 90°$		
Tooth Angle or Angle Increment	δ	$\tan. \delta = \frac{2 \sin. \phi}{N_1}$		
Face Angle		$(90° - \phi) + \delta$		$(90° - \theta) + \delta$
Cutting Angle		$\phi - \delta$		$\theta - \delta$
No. of Teeth for which to select Cutter	N'_1	$\frac{N_1}{\cos. \phi}$	N'_2	$\frac{N_2}{\cos. \theta}$
Backing Increment	B_1	$\frac{\sin. \phi}{P}$	B_2	$\frac{\sin. \theta}{P}$

TABLE 2. FORMULAS FOR BEVEL GEAR PROBLEMS—SHAFTS NOT AT 90 DEGREES.

we were laying out the pair the first thing we would do would be to find the center angle by laying down the diameters on their respective shaft centers; therefore the most natural thing to do now is to find the center angle of one of the gears, say that of the pinion. We know from trigonometry that the tangent of an angle is equal to the side opposite the angle divided by the side adjacent, or from Fig. 1 the tangent of the center angle of the pinion:

$$\tan. \phi = \frac{c}{b}.$$

In the figure it is seen that the diameter of the pinion is proportional to c and that b is proportional to the diameter of the gear.

$$\therefore \quad \tan. \phi = \frac{D_1}{D_2} \qquad (1)$$

Let P = diametral pitch and N_1 and N_2 = the number of teeth in pinion and gear respectively, and since the diameter equals the number of teeth divided by the diametral pitch we get by substituting in (1)

$$\tan. \phi = \frac{N_1}{P} \times \frac{P}{N_2} = \frac{N_1}{N_2} \qquad (2)$$

If we wish to know the center angle of the gear we simply invert the second term and solve thus:

$$\tan. \theta = \frac{N_2}{N_1} \qquad (3)$$

If O be the angle between the shafts, then $\theta = O - \phi$. When the shafts are at 90 degrees, θ is the complement of ϕ.

Again referring to the method of laying out the gears graphically, the next thing we would get would be the face and cutting angles, which are found in Fig. 1 to be the sum and difference of the center angle and the angle of the tooth, which is represented by δ. The tangent of an angle being equal to the side opposite the angle divided by the side adjacent, we have:

$$\tan. \delta = \frac{d}{\left(\frac{a}{2}\right)} \qquad (4)$$

where a is twice the slant hight of the pitch cone and d the addendum or hight of tooth above the pitch line.

The sine of an angle is equal to the side opposite divided by the hypothenuse, which if applied to the center angle of the pinion gives:

$$\sin. \phi = \frac{D_1}{a} \qquad (5)$$

or

$$a = \frac{D_1}{\sin. \phi} \qquad (6)$$

The addendum is equal to the reciprocal of the diametral pitch number, or $\frac{1}{P}$, which value we enter in (4) and get:

$$\tan. \delta = \frac{\left(\frac{1}{P}\right)}{\left(\frac{a}{2}\right)},$$

and substituting the value of a as given in (6) we obtain:

$$\tan. \delta = \frac{\frac{1}{P}}{\frac{D}{2 \sin. \phi}} = \frac{2 \sin. \phi}{PD} \qquad (7)$$

The number of teeth in a gear is expressed by the following formulas:

$$N_1 = D_1 \times P$$
$$N_2 = D_2 \times P$$

Substituting these values in (7) we get:

$$\tan.\ \delta = \frac{2 \sin.\ \phi}{N_1} \qquad (8)$$

$$= \frac{2 \sin.\ \theta}{N_2} \qquad (9)$$

The only remaining dimension is the outside diameter of the blanks. From Fig. 1 we see that the outside diameter of the gear is equal to the pitch diameter plus what we call the diameter increment, or

$$O\,D_1 = D_1 + d_1 \text{ for pinion} \qquad (10)$$

$$O\,D_2 = D_2 + d_2 \text{ for gear} \qquad (11)$$

By trigonometry we have, the cosine of an angle is equal to the quotient of the side adjacent divided by the hypothenuse. By inspection of Fig. 1 we see that d is the hypothenuse and that $\frac{d_1}{2}$ is the side adjacent and the angle is ϕ.

$$\therefore \quad \cos.\ \phi = \frac{\frac{d_1}{2}}{d},$$

$$\text{or} \quad \frac{d_1}{2} = d \times \cos.\ \phi.$$

Since $d = \frac{1}{P}$ we have

$$\frac{d_1}{2} = \frac{1}{P} \cos.\ \phi$$

$$d_1 = \frac{2}{P} \cos.\ \phi \qquad (12)$$

$$d_2 = \frac{2}{P} \sin.\ \phi \qquad (13)$$

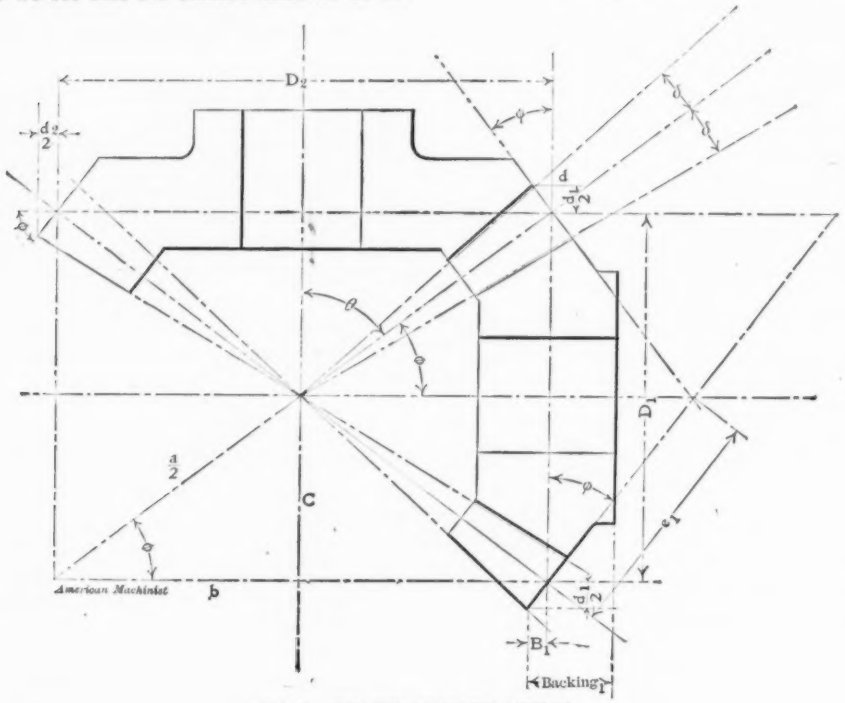


FIG. 1. SHAFTS AT RIGHT ANGLES.

Formula (13) applies only in case the shafts are at 90 degrees, otherwise (13) becomes:

$$d_2 = \frac{2}{P} \cos.\ \theta \qquad (14)$$

Now, $D_1 = \frac{N_1}{P}$ and $D_2 = \frac{N_2}{P}$, and substituting in (10) and (11) we get

$$OD_1 = \frac{N_1}{P} + \frac{2 \cos.\ \phi}{P} = \frac{N_1 + 2 \cos.\ \phi}{P} \qquad (15)$$

$$OD_2 = \frac{N_2}{P} + \frac{2 \cos.\ \theta}{P} = \frac{N_2 + 2 \cos.\ \theta}{P} \qquad (16)$$

We come now to an item which one seldom finds on a drawing, but which will be appreciated by any operator cutting bevel gears with a rotary cutter; this is the number of teeth for which to select the cutter. Bevel gears being unlike spur gears, the cutter cannot be selected for the number of teeth in the gear, but must be proportional to a spur gear with a radius equal to the slant hight of the back cone of the gear, as at e, Fig. 1. Since e_1 = radius of a spur of the proper number of teeth, that number must equal

$$N' = 2e_1 \times P \text{ and } N'' = 2e_2 \times P,$$

where

$$e_1 = \frac{D_1}{2} \times \frac{1}{\cos.\ \theta} \text{ and } e_2 = \frac{D_2}{2} \times \frac{1}{\cos.\ \theta}.$$

Substituting these values in the above formulas,

$$N' = \frac{D_1 P}{2 \cos.\ \phi} \text{ and } N'' = \frac{D_2 P}{2 \cos.\ \theta}.$$

Since $N_1 = D_1 P$ and $N_2 = D_2 P$, we get

$$N' = \frac{N_1}{2 \cos.\ \phi} \qquad (17)$$

$$N'' = \frac{N_2}{2 \cos.\ \theta} \qquad (18)$$

When shafts are at 90 degrees formula (18) becomes:

$$N'' = \frac{N_2}{2 \sin.\ \phi} \qquad (19)$$

The above formulas will give all the data necessary for bevel gears on shafts at any angle with the exception of (1), which applies to shafts at 90 degrees only.

GEARS WITH SHAFTS AT LESS THAN A RIGHT ANGLE.

We see by Fig. 2 that

$$\tan.\ \phi = \frac{R_1}{a} \qquad (20)$$

but we see also that we have not the length of a. If we erect a perpendicular at the point of intersection of the pitch lines and produce it so as to intersect the axis of the pinion and thru this point of intersection we draw a line parallel to the pitch line of the gear, we have two sections of the line a which we can obtain:

$$d = \frac{R_2}{\sin.\ O} \text{ and } e = \frac{R_1}{\tan.\ O},$$

The sum of these two quantities is equal to the line a, which value we substitute in (20), giving:

$$\tan.\ \phi = \frac{R_1}{\frac{R_2}{\sin.\ O} + \frac{R_1}{\tan.\ O}}.$$

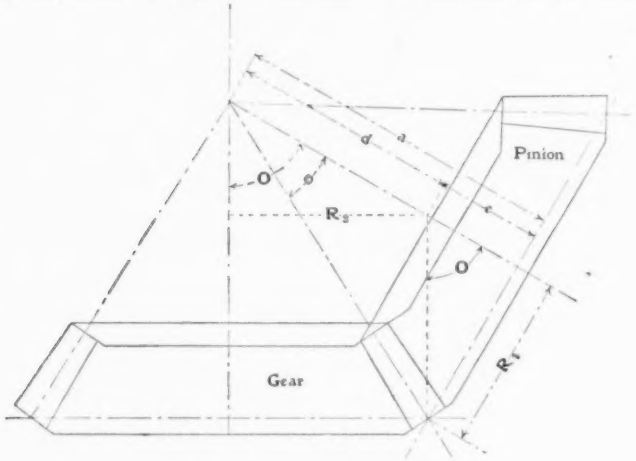


FIG. 2. SHAFTS AT LESS THAN 90 DEGREES.

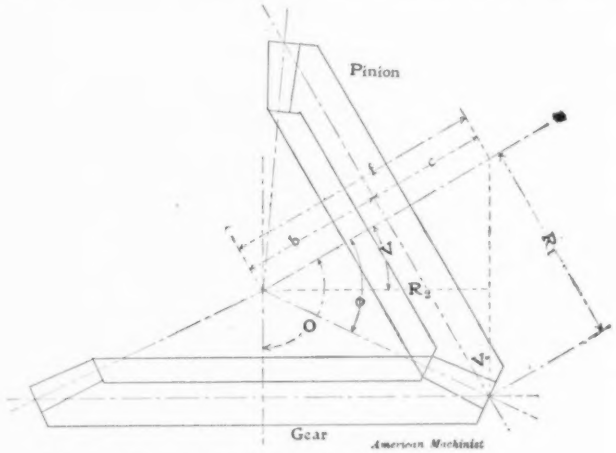


FIG. 3. SHAFTS AT MORE THAN 90 DEGREES.

Dividing by R_1

$$\tan.\phi = \frac{1}{\frac{R_2}{R_1 \sin. O} + \frac{1}{\tan. O}} = \frac{1}{\frac{R_2}{R_1 \sin. O} + \frac{\cos. O}{\sin. O}}$$

Multiply by sin. O:

$$\tan. \phi = \frac{\sin. O}{\frac{R_2}{R_1} + \cos. O},$$

Since R_2 and R_1 are directly proportional to the number of teeth in the respective gears, we have:

$$\tan. \phi = \frac{\sin. O}{\frac{N_2}{N_1} + \cos. O} \qquad (21)$$

GEARS WITH SHAFTS AT MORE THAN A RIGHT ANGLE.

By Fig. 3 it is seen that the angle is to be obtained by

$$\tan. \phi = \frac{R_1}{b} \qquad (22)$$

But we must first obtain the length of b. By inspection we see that by drawing a perpendicular from the point of intersection of the pitch lines so as to intersect the axis of the pinion and a line drawn at right angles to this perpendicular so as to pass thru the point of intersection of the two shaft centers, we will have means of obtaining f and c, which are:

$$c = \tan. V \times R_1 \text{ and } f = \frac{R_2}{\cos. V},$$

$$b = f - c = \frac{R_2}{\cos. V} - \tan. V \times R_1,$$

which we substitute in (22) getting

$$\tan. \phi = \frac{R_1}{\frac{R_2}{\cos. V} - \tan. V \times R_1},$$

dividing by R_1,

$$\tan. \phi = \frac{1}{\frac{R_2}{R_1 \cos. V} - \tan. V}$$

$$= \frac{1}{\frac{R_2}{R_1 \cos. V} - \frac{\sin. V}{\cos. V}}.$$

Multiplying by cos. V,

$$= \frac{\cos. V}{\frac{R_2}{R_1} - \sin. V},$$

As before, substituting N_2 and N_1 for R_2 and R_1 respectively, we have:

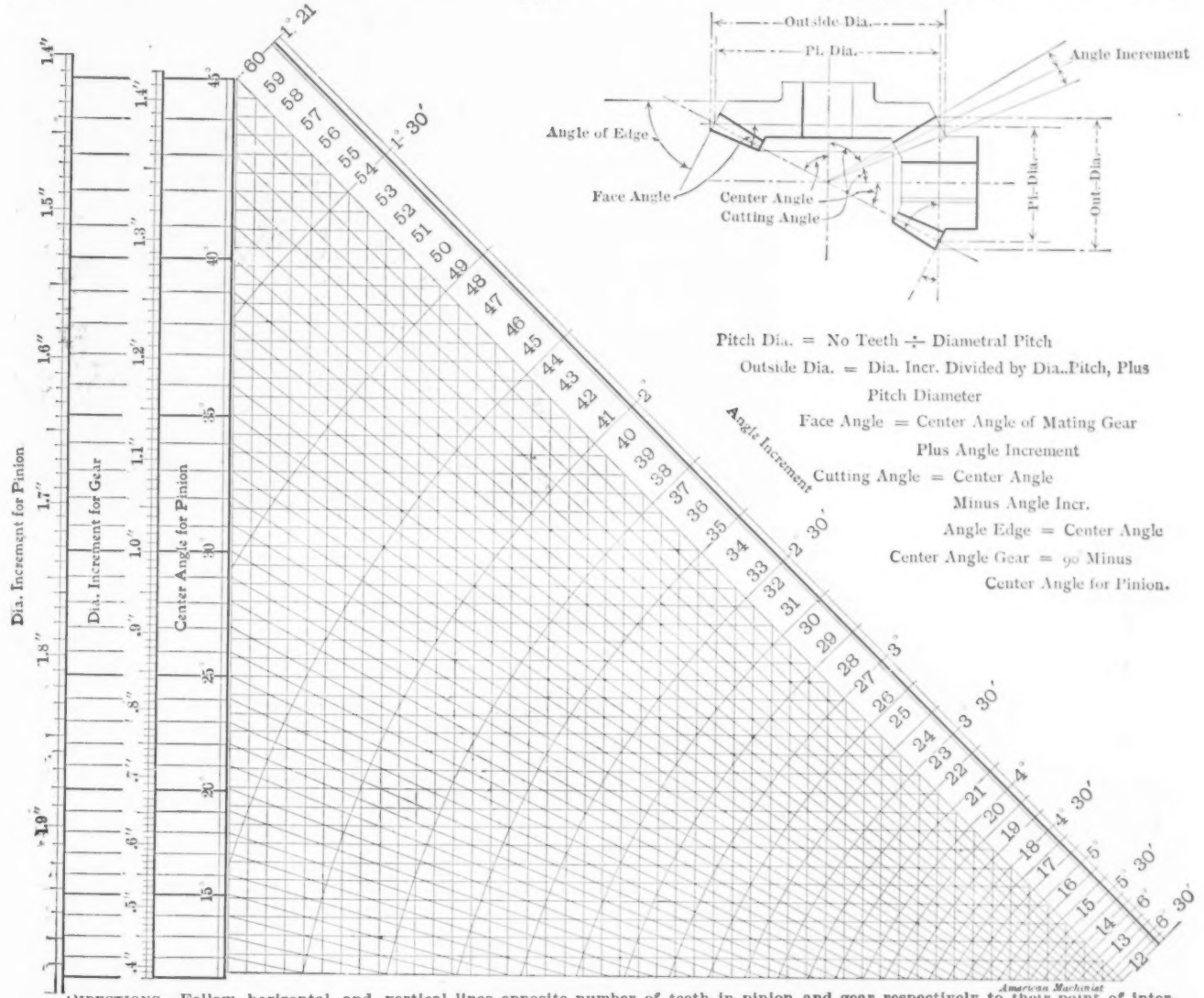
$$\tan. \phi = \frac{\cos. V}{\frac{N_2}{N_1} - \sin. V} \qquad (23)$$

Formulas for the last two cases will be very handy, as it is exceedingly difficult to lay out gears at such angles and obtain accurate results.

BEVEL GEAR CHART.

In order to overcome the objection usually made to the use of trigonometric functions, I have designed the chart which accompanies this article, the use of which will enable the necessary data to be obtained without reference to any quantity not found on the chart. The chart is self-explanatory, and its use to obtain fairly accurate results depends on the skill acquired in reading scales.

It is desired that the above treatment will be accepted by those already posted on the subject, with allowance for what they may consider old matter, but they will readily admit that there is at present no thorough treatment of the bevel gear problem, and it is hoped that this article may help fill this vacancy.


Outside Dia.
Pi. Dia.
Angle Increment
Angle of Edge
Face Angle
Center Angle
Cutting Angle
Pi. Dia.
Out. Dia.
Pitch Dia. = No Teeth ÷ Diametral Pitch
Outside Dia. = Dia. Incr. Divided by Dia. Pitch, Plus Pitch Diameter
Face Angle = Center Angle of Mating Gear Plus Angle Increment
Cutting Angle = Center Angle Minus Angle Incr.
Angle Edge = Center Angle
Center Angle Gear = 90 Minus Center Angle for Pinion.
Dia. Increment for Pinion
Dia. Increment for Gear
Center Angle for Pinion
Angle Increment
American Machinist

DIRECTIONS—Follow horizontal and vertical lines opposite number of teeth in pinion and gear respectively to their point of intersection; from there trace on the circular arc to the right-hand scale and read *angle increment;* from point of intersection trace along oblique line to scale reading *center angle for pinion,* then horizontally thru scales reading *diameter increment* for pinion and for gear.

FIG. 4. BEVEL GEAR CHART.

Australian Duties on Machinery.

A supplement of the Australian tariff makes some new requirements, and is so explicit as to regulations governing importations and exportation that it is worthy of more than passing note.

Entries are to be made in triplicate, a genuine invoice for the goods must be presented, and trans-shipment entries must be quadruplicate.

Whenever the collector assesses the value of goods for duty, the entry is to be amended accordingly, unless within two days the owner of the goods shall express his objection to the same in writing. If this is done, the value must be determined by experts, one to be appointed by the owner and the other by the collector. The value agreed upon is to be the value of the goods for duty. If they fail to agree, an umpire is then appointed. The costs of the evaluation are to be paid by the owner if the decision is adverse to him; if in his favor, they must be paid by the customs.

Travelers' supplies are admitted free, but must be covered by application for transfer, security to be given guaranteeing their return and outward entry within six months.

Import entries of goods at a fixed rate of duty show the number of the manifest, the marks and numbers of the packages, a description of the goods, their quantity or weight, the country of origin, value in English currency, rate of duty, and total amount of duty, also in English currency.

Entry for goods ad valorem varies in that the form must also show the invoice price and value for duty. The importer must make oath that this is the correct and only invoice that he expects to receive for the goods; that the value mentioned is the fair market value in the principal markets of the country of origin at the time of shipment, without any reduction other than what would be allowed in the ordinary purchase of such goods.

For goods entitled to entry free of duty the requirement must show the number on the manifest, marks and numbers of the packages, a description of the goods, quantity, country of origin and value.

Among the articles admitted free are the following: Copying lathes for metal, molding machines, rock drills, coal cutters, prospectors' furnaces, root cutters, wire fencing, log carriages for sawmills, agricultural motors, paper box machines, repair parts for air brakes, blowers above 2 feet in diameter and power stripping machines.

On the following the duty is 12½ per cent.: Fire apparatus, hydraulic presses, rim and felloe bending machinery, auto-transformers, belt conveyors, tinmen's machine tools, general sawmill plant, boot and shoe machinery, power hammers, stone planing machines, blowers up to 2 feet in diameter. Another list includes articles upon which 20 per cent. is charged such as adding machines, Armstrong tool-holders, portable forges, copper smelting furnaces.

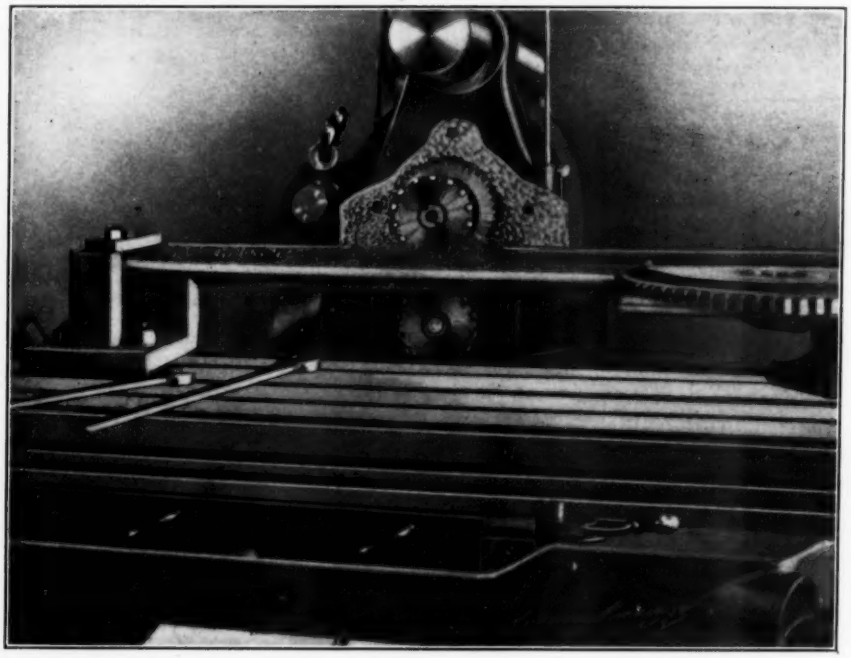


FIG. 1. MILLING A SAWMILL KNEE.

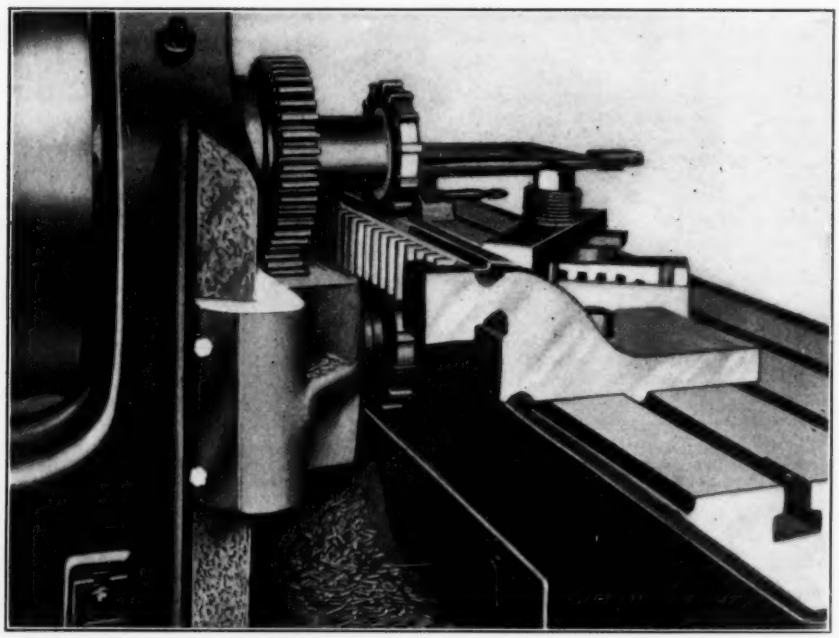


FIG. 2. MILLING A SAWMILL KNEE.

Benefit Association at the Crocker-Wheeler Works.

At the works of the Crocker-Wheeler Company, Ampere, N J., the employees have recently organized a beneficial association. The officers of the company are all employees, the president, James Moore, running one of the big planers. The other officers are a vice-president, financial secretary, recording secretary and treasurer. The system employed is extremely simple. Every employee who pays 10 cents a week will be entitled to $10 a week for twenty weeks in case of sickness or disablement. If he dies his family will receive $100. The payment of 20, 30 or 40 cents a week secures weekly payments of $15, $20 or $25 a week, respectively, with death benefits of $150, $200 or $250. The company, while not requiring representation in the association, has volunteered to contribute to its funds an amount equal to that paid in by the members.

Dull tools cut most fingers.

Double Spindle Milling Attachment.

EDITORIAL CORRESPONDENCE.

The accompanying illustrations show an interesting application of a supplementary spindle to a milling machine at the works of the Frick Company, Waynesboro, Pa.

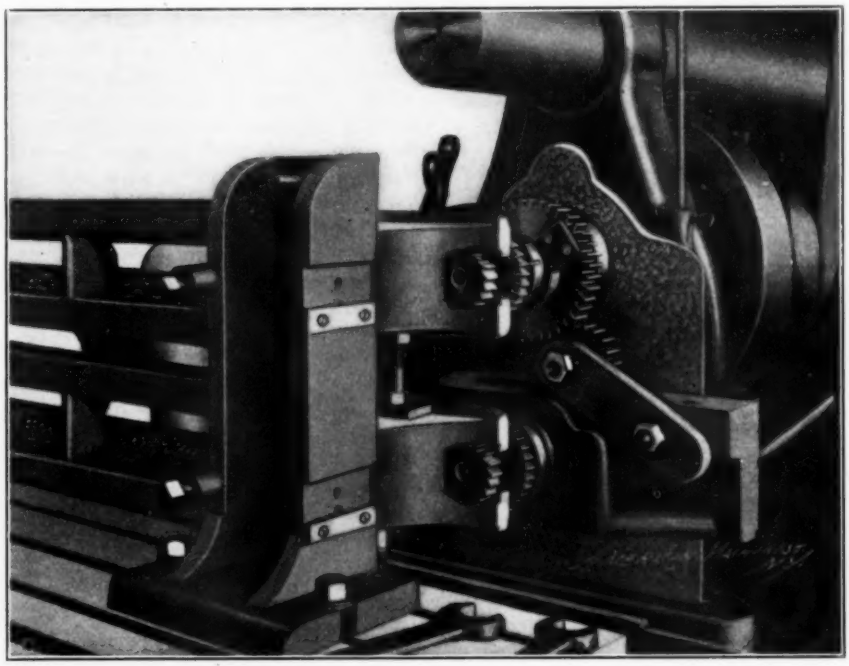


FIG. 3. MILLING SAWMILL KNEE GUIDES.

Figs. 1 and 2 show the attachment at work on the knee of a sawmill set works. The working of the attachment will be clear from the illustrations, the grooves on both sides of the knee being milled at the same time. The adjustment of the distance between the cutters to secure the proper size of the work is obtained by moving the attachment on the column, the meshing of the teeth of the connecting gears being slightly varied in depth. The cutters have inserted teeth of high-speed steel, which are simply driven to place without securing devices other than a tight fit, and they hold their size for a long time. This style of cutter is in very large use at the Frick works, dozens of gangs of such cutters being in use, and the work done is strictly up to date as regards speed.

Fig. 3 shows the same attachment arranged for milling the slide which spans a sawmill carriage and which receives and guides the knee. The gears on the main and supplementary spindles are here connected by an idler, which causes both spindles to revolve in the same direction. The lower working edges of both pieces are milled at the first pass of the machine, and by dropping the carriage at the end of the cut the cutters are brought to position to finish the upper edges. The cutters in this case are of ordinary steel and are arranged in gangs of three, the entire edge, including the top surface, the slot edge and the lower surface being milled simultaneously and to fit the knee shown in Fig. 1.

Fig. 4 shows the attachment arranged as in Fig. 3, with both cutters revolving in the same direction and completing two pieces at each pass.

F. A. H.

Antipodean Locomotive Prices.

A little time ago a dispute arose in New South Wales regarding the supply of a number of locomotives for the government railways. The matter was referred to the State Railway Commissioners, who have just issued their report. According to this, the locomotives can be imported at prices considerably lower than those at which they could be supplied by local firms. One local firm offered to construct 120 locomotives, of certain specified types, for the sum of £643,200, or, deducting various charges returned by the Federal Customs, £632,120, or £5,260 each. This is £1,236 2s. 6d per engine higher than the tender received from an American company for the building of only twenty locomotives. If 120 locomotives were required, the cost per engine would be considerably lower. If the offer of the local firm were accepted, the commissioners state that the 120 locomotives would cost £148,575 more than those of the American company at current rates. Moreover, it would take twelve years to execute the order. The highest British tender per engine was less by £549 5s., and the lowest £851 8s. than that of the Australian firm. Commenting on these figures, the State Premier points out that the State can buy in the open market the locomotives it requires at a price which would enable it to save sufficient money from the local price to make a present of £400 ($2,000) to each of the 223 mechanics who would be required, and have £12,380 to spare.—*Engineering Times*, London.

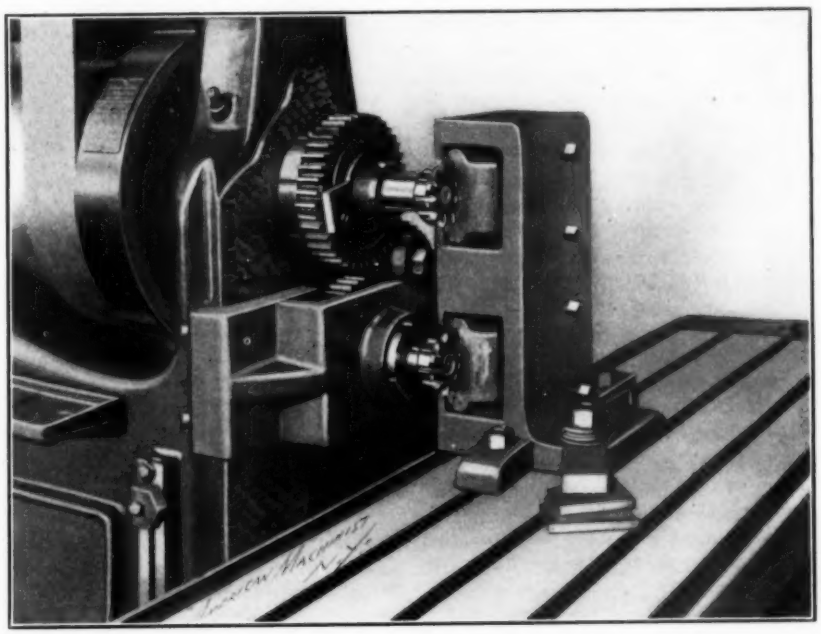


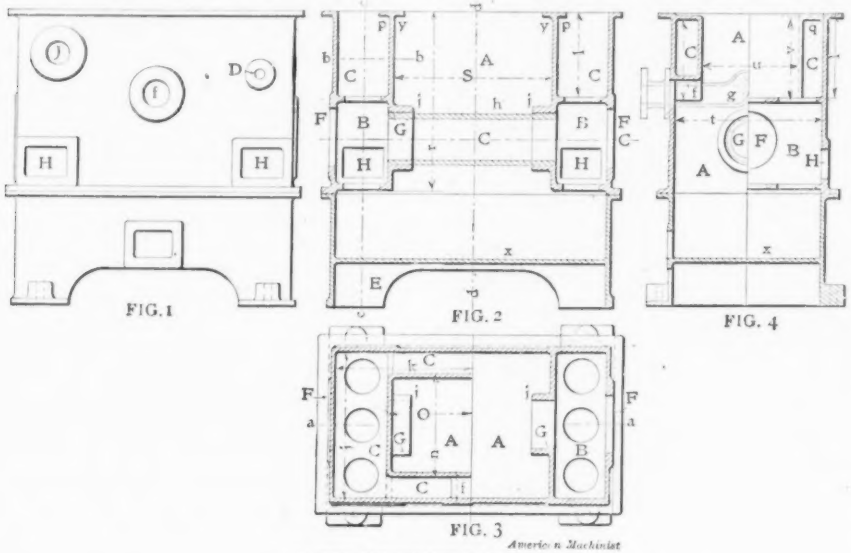
FIG. 4. COMPLETING TWO PIECES AT THE SAME OPERATION.

A friend in San Francisco sends us a proposition from an oil company located in that city, which, tho so far from Cleveland, Ohio, seems to have the same unfortunate experience in shipping oil and has the same method of getting out of its difficulty; that is, having the oil "near you" it offers it at a reduced price "rather than pay the return freight" to San Francisco. While this may be a straight game in San Francisco, it is obviously the same game that is played in Cleveland, and is at least open to the same suspicion.

A Jet Condenser Casting and the Pattern Work for It.

BY JOSEPH HORNER.

Figs. 1-4 illustrate the casting for a jet condenser, of which I have made several in different sizes by the methods to be here described. These are used on compound horizontal engines, being bolted on the engine bed-plate, or an extension of it, and the feed pump draws from the water



A JET CONDENSER CASTING.

chamber in the upper part of the condenser. It is not necessary to dimension the casting, as the methods only are under consideration; but this particular example measures about 4 feet in length and in hight, by about 2 feet 3 inches in width. It is cast in two main parts, the lower one being a comparatively simple piece of work, the upper involving a considerable amount of coring and requiring care in making, setting, and venting.

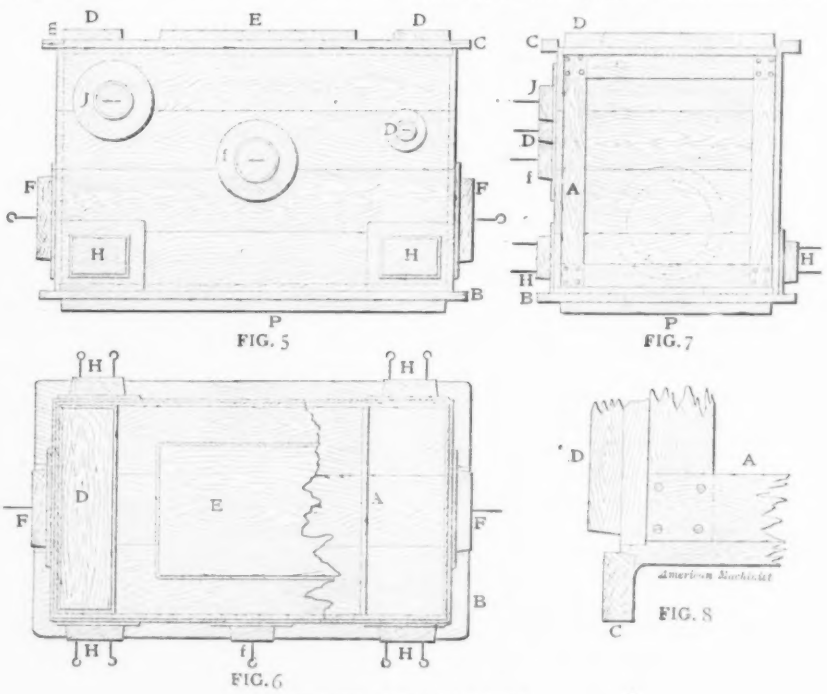
Fig. 1 is an external longitudinal elevation of the condenser, Fig. 2 a sectional elevation along the center, taken at *a a*, Fig. 3. The latter comprises two plan sections, the one to the left taken in the plane *b b* of Fig. 2, that to the right in the plane *c c* of the same. Fig. 4 gives, to the left, a vertical end section taken thru the center *d d* of the condenser in Fig. 2, and to the right, one taken thru the vertical plane *e e*.

The details of the casting are as follows: *A* is the chamber for the exhaust steam, which is brought in thru the central top cover. None of the covers are shown, as they do not concern the making of the body. The injection pipe is indicated at *g* in Fig. 4, coming in thru the hole *f* at one side.

The brass pump barrel is indicated at *h*. This is turned and forced tightly into the bores *G* of the bosses *j j*. The double-acting pump draws the water from the lower part of the chamber *A* up thru the valve chambers *B B* into the water space *C*, whence the feed pump draws it thru the hole *D*. These are the principal elements, the various valve seats, doors, overflow, etc., need not be particularized. In this article we take the pattern work only, beginning with the top or principal casting.

THE PATTERNS.

The pattern is shown in Figs. 5-7, Fig. 5 being an elevation, Fig. 6 a part plan and part plan section, and Fig. 7 a cross-section taken near the end adjacent. Being large, the pattern is of course not made solid, but is boxed up and is further supported to prevent ramming inward, upon



framings *A*, Figs. 6 and 7. The pattern ends are grooved into the sides, see Figs. 7 and 8, also to prevent in-ramming, and the top and bottom are let into rebates in the sides and ends, with the same object. Having the four framings *A* spaced equally away from the ends, the body of the pattern is complete and rigid. On this the various flanges and facings are fitted as follows:

Two flanges *B* and *C* are attached. *B* is made solidly in strips, and fastened on by screws; *C* is made as a frame and rebated into the sides loosely to be left in the bottom of the mold, the pattern molding with the top side of the condenser downward. An enlarged section of this fitting is shown in Fig. 8. The reason for the shouldering down of the pattern face below the flange *C*, in Figs. 7 and 8, is partly to give allowance for tooling on the face of *C*, and partly because the metal over the spaces *C C* (Fig. 4) is below the level of the flanges, so that useless tooling there shall be avoided.

Prints are put on the covers, as shown in Figs. 5 and 6, the connection of which with the casting, Figs. 1-4 will be readily apparent. All the facing bosses and their prints must be left wired loosely on, to be withdrawn after the delivery of the pattern body. Sundry reference letters on the pattern body relate to core boxes, cores, and mold, to be noticed as we proceed. The pattern, it will be understood, molds upside down, or in the opposite way to which it stands in Figs. 5-7.

CORE BOXES.

We will commence the core boxes in the order in which the cores go into the mold, the first being that for the water space *C*. By comparing Figs. 2 to 4, this space is seen to pass right around the condenser, encircling the exhaust steam chamber *A*. Being a large core, it and its box, Fig. 9, are made of half the length only, the jointing taking place transversely. The main internal dimensions of the box are *j* and *k*, corresponding with similar lettering on Fig. 3, and *l'* corresponding with the depth *l* in Figs. 2 and 4, plus the print thickness *m* of *D* in Figs. 5, 6 and 7. Away from the print *D* the core receives no support excepting from chaplets, so that the

box has some blocking inserted. In this blocking the width *n* of the main piece corresponds with *n* in the plan, Fig. 3, and its length *o*, with *o* in that figure. Then there is a flange *p* and two strips *q q*, which form the flanges *p p* in Fig. 2, and the metal at *q q* in Fig. 4, plus in both cases the print thicknesses *m*, as already noted in connection with the total depth of the box. A boss segment *f* is inserted as shown, to give the metal over the concavity *f*, cored out for the insertion of the injection pipe *g*; compare with Figs. 3 and 4.

The box for the exhaust steam chamber is shown in Fig. 10. Its depth *r* is equal to the depth *r* in Fig. 2, plus the thickness of the print *E* in Figs. 5 and 6. The width *s* of the box corresponds with *s* in Fig. 2, and the bosses *j j* with the bosses in that figure. The space between these is bridged with a round print *G* for the holes *G*, receiving the pump barrel. In the other direction comparison is to be made with Fig. 4, the widths *t* and *u* corresponding in Figs. 10 and 4, and the depth *v* with *v* in Fig. 4, plus the thickness of the print *E*. The shoulders therefore of *v* give the metal underneath the water space *C* at that locality. The strips *y y* form the flanges *y y* in Fig. 2, the difference in the depth being of course that due to the thickness of the print *E*.

Fig. 11 is the box for coring out the two valve chambers *B B*, the dimensions and coincidences of which are obvious by comparison with the casting in Figs. 2, 3 and 4, the length, width and depth corresponding in both. The valve seatings, it will be noted, are all formed in this core. Alternatively, one set might be formed in the space box *x*, Fig. 9; but, having them in the one box, as in Fig. 11, they are sure to be plumb over each other. The top and bottom pieces *w w*, in which the seatings are cut, are doweled on the box framings. They need not be divided longitudinally for delivery of the round cores, since a little taper from the outer toward the inner faces will suffice for delivery in the perpendicular direction.

There are several other cores, but it is not necessary to illustrate their boxes. A core of large area has to fill the impression of the print *P*, Figs. 5 and 7. This is plain rectangular, and lies on the core for the exhaust steam chamber made from the box, Fig. 10. The print *P*, being in the top, would not be necessary but for the purpose of giving sufficient thickness to the core to prevent it from fracturing. The small cores are those for the various openings in the sides of the condenser. Boxes are made for the square ones. The round ones, including those for the pump barrel bosses, are made in standard boxes, and cut off.

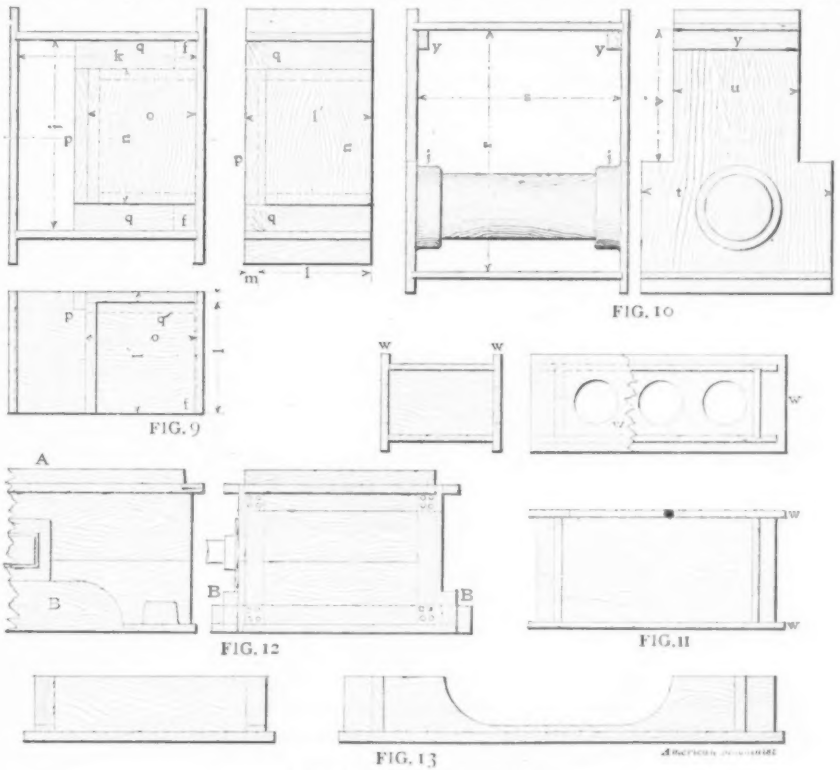


FIG. 10

FIG. 9

FIG. 12

FIG. 11

FIG. 13

CORE BOXES FOR CONDENSER.

The pattern for the lower part of the condenser is shown in Fig. 12. It is boxed up similarly to the upper portion, including the supporting diafram framings, and the flange that comes lowermost in the casting is left loose. There are but two cores, disconnected, the space between forming the floor *x*, Figs. 2 and 4, of the exhaust steam chamber *A*. The space above *x* is taken out with a quite plain rectangular core fitting into the impression left by the print *A*, Fig. 12, this core going into the bottom of the mold. The space below *x* is taken out with a core made in the box, Fig. 13. The side prints *B B*, Fig. 12, afford sufficient support to the core without any other aid. The box is shown as it lies when being rammed.

The molding of the condenser will be considered in another article.

Bath, England.

Specification for the Construction of an Electrical Engineer

If the following specification had been printed with usual blank spaces, it might have been filled in as applying as well to civil, mechanical, mining or other engineers. It forms part of a paper by George A. Damon before the electrical section of the Western Society of Engineers.

In General.—The purport and intent of this specification is to cover the labor and material required to produce in complete working order a man prepared to attain his own ideal of success in that branch of electrical work which he may elect.

It is to be understood that the omission of the mention of small details in this description does not obviate the necessity of their being furnished. What is wanted is a thoroughly trained, well seasoned, broad minded man, complete with an individual character, a strong intellect, and a sincere purpose.

Plans.—He will form his ambition early in life.

He will take a natural interest in the history of men of eminence in his chosen work and their achievements will inspire him with a desire to accomplish great things.

He will develop his imagination and constantly broaden his conception of his own possibilities.

He will seek to learn what the world wants and then will endeavor to train his natural abilities so as to supply that want.

Foundations.—He will as a boy develop a knack of "doing things" either as a mechanic, as a draftsman, or in some boyish business enterprise, and a combination of any two or all three proclivities is desirable.

He must early learn the advantage of doing some one thing well, but he should not allow praise for his proficiency to encourage him to neglect study along the lines he does not naturally fancy.

He will prepare for college and during this period of preparation he will get enough experience in practical work to demonstrate that he has made a wise choice for his life work.

He will not let the attractions of practical work interfere with his intentions to secure the best theoretical and technical training the country affords.

Dimensions.—He will endeavor early to "earn money" by doing useful work, and will seek employment outside of his study hours. Everything he attempts he will complete to the best of his knowledge and ability.

He will put himself on a self-supporting basis as soon as possible, and will earn his own way thru college. If he receives

financial assistance, he will treat it as borrowed money, to be returned, and he will keep the debt within reasonable limits.

He will not allow any false sentiment "to finish with his class" prevent him from stopping out one or even two years during his college course to add to his store of practical experience along electrical or allied lines.

He will determine for himself whether he intends to realize on his possibilities quickly or whether he will lay a broader foundation for a slower but higher development.

Capacity.—Even if the young man possesses only ordinary talents, his capacity for hard, conscientious, intelligent, well-directed work will attract attention and win advancement.

When the occasion demands he will be able to stand a long run on overload or respond to excessive demands for short periods without permanent injury.

He will be able to direct others and will not depend entirely upon his unaided efforts for results.

Operation.—He will work quietly, and will be turning in the right direction every minute in a simple, direct, and accurate way.

He will join that great army of workers who are actually doing things rather than that smaller class of men who occupy most of their time in telling what they are going to do.

Parallel Operation.—As a student he will enroll as a member of the Student Branch of the American Institute of Electrical Engineers and take a lively interest in the Institute papers and discussions. In practise he will advance to Associate membership and will look forward to the day when he has added sufficient to the art to be considered worthy of Active membership.

He will make friends among his superiors, who will respect his ambitions and will be glad to assist him in realizing his ideals.

He will study men and know how to deal with them.

Work to be Done by Others.—Parents should study their children and encourage them to develop their natural tendencies.

Teachers should get hold of their students personally and as far as possible treat each case individually.

More occasions should be made for successful men to meet students and give them the benefit of their advice and experience.

The students should not be isolated in a little world of their own, but should be brought in contact with an atmosphere of actual affairs.

Above all, some method must be devised to guide the young man to and thru the course of practical experience best adapted to his qualifications and purpose in life.

Shop Tests.—If he enters the shop or testing department of a manufacturing company, he will make a bargain which will result in his getting an all-around experience in exchange for his services, and, while in the shop, will keep on the move in every sense of the word.

He will seek to make himself thoroughly practical in all his ideas and methods of work.

Finish.—He will include in his preparations considerable literary work and will seek after general culture. He will study at least one foreign language.

He will regard his college work as only the beginning of his education and will be a student always.

He will seek practise in the art of expressing himself, and will occasionally write a paper on some technical subject.

He will become interested in some social, educational or reform movement, and will avoid becoming a recluse interested only in his own work.

Inspection.—During his Senior year he will submit a thesis in competition for the Edison Medal, and even if he fails to get the prize his effort will demonstrate his sincerity and will show the thoroughness and breadth of his preparation.

Fittings.—He will find it necessary to possess accurate knowledge of nearly every branch of science, including physics, chemistry, mathematics, mechanics, pneumatics, hydraulics, mining, metallurgy, and civil engineering.

He must know something about accounts and a great deal about business and commercial law.

He will find that the electrical business is so broad in its scope that a natural aptitude in any direction can be made of use.

Completion.—He will make every sacrifice to get a thorough preparation and a broad experience up to the age of twenty-eight or thirty years.

He will accomplish much between the age of thirty and forty-five, at the end of which time he will be well settled in his business or profession.

Let us leave him at this time to inherit his own. May he live long and prosper.

The Largest Floating Dock.

The largest steel floating dock in the world is approaching completion at Sparrows Point, Maryland. It is being built for the United States Government and will be towed to the Philippines, 14,000 miles. It is 500 feet long over all, 100 feet wide inside and 134 feet wide outside, the side walls being 42 feet high inside and 64 feet outside. The structure contains 11,000 tons of steel and 2,000,000 rivets. When floating at its lightest it will draw 6½ feet of water and when submerged to give a draft of 30 feet it will require a depth of 63 feet. It will lift a 16,000-ton battelship and 4,000 tons more. The dock is equipped with a complete machine shop for ordinary repairs and has also an electric plant and water distilling apparatus. Nine officers and twelve men will be provided with permanent quarters.

The Lay-out and Construction of Cams—Cams for Rapid Motion.

BY B. A. LENFEST.

At page 1349, Vol. 27, "Veteran" when laying out a cam has ingeniously used, in place of the harmonic curve, a curve based on the ellipse; the effect being to start the motion of the follower more slowly and end with less velocity than with the unsatisfactory harmonic curve, while the velocity at or near the middle of the path of the follower will be considerably higher. In other words, allowance has been made to both start and stop the follower with the least possible velocity consistent with a manageable velocity at the mid-path position.

"The proof of the pudding is in the eating" certainly, and "Veteran" has offered valuable testimony as to the satisfaction derived from the ellipse curve method of cam design. There is reason to believe, however, that the ellipse is not the best curve to use in this case, nor can it be defended on scientific grounds—that is, by the application of the laws of mechanics.

There is, however, another curve that can be applied that has a scientific basis, namely, the gravity curve, or the curve of uniform acceleration and retardation. It is desired, herein, to explain this curve as well as the others mentioned in a comparative way. One of the best treatments of this subject is found in Schwamb and Merrill's "Mechanism," recently published by the Wileys. At page 64 is given a defense on scientific grounds for the use of the uniformly accelerated and retarded form of curve. It is believed, however, that a few words more will make the connection clearer and these words it is the purpose of this discussion to furnish. A rather sketchy treatment is to be found in Rouillion's "Drafting of Cams," published by the Derry-Collard Company. Mr. Rouillion at page 19, under the title "Designing a Belt Shifter," has presented one of the problems that has been given for many years at Cornell University, and has there made use of the gravity curve.

VARIOUS CAM CURVES.

Referring to the illustration, suppose it be desired to move a follower from *A* to *B* at a rapid rate by pushing the cam *A C D* (in this case a translation cam) to the left. There are shown five methods of accomplishing this:

1. The follower may be started at the velocity it is to have throughout the motion, in which case the outline of *A D* will be a straight line (1). This will naturally give a sudden and injurious shock at the start *A* and there will be a tendency, dependent on the speed, to move above *B*. Both effects are fatal at high speeds.

2. Some improvement can be obtained by using the outline (2) which is a straight line ended by arcs of circles tangent at *A* and *D*, but the curved portion must take

care of the entire increase of velocity from 0 to the maximum, a much less efficient method than to distribute this acceleration over the half path of follower.

3. The dotted curve (3) may be used, which is the harmonic curve that "Veteran" has found unsatisfactory.* It is constructed, as shown in the figure, thus: Divide the semicircle (dotted) into twelve equal parts numbered 0 to 12; divide the length $A\,C$ of the cam into the same number of equal parts 0 to 12. Then project the points from the semicircle to vertical lines drawn from the corresponding points on $A\,C$. A curve drawn thru these points will be the harmonic curve and the follower will be moved from A to B in perfect harmonic action for a given uniform velocity of the cam. It will be noted that precisely the same motion is imparted to the piston of a Clayton air compressor or a Jeffers or Hunnewell steam fire engine, for these types of machines have no connecting rod, but replace this connecting rod by a slotted crosshead or "Scotch yoke," so called.

high velocity at the mid-path position. It will be possible to reach a limit beyond which the question of friction at the middle of the path prevents further increase of the follower's velocity.

5. The gravity curve, or, as more often called, the curve of uniform acceleration and retardation, (5) is finally considered. The construction is as follows: Divide $A\,C$ as for the harmonic curve; draw the line $A\,E$ at any convenient angle with $A\,B$ and lay off on it, to a convenient scale, distances from A to F and from E to F equal to the odd numbers 1, 3, 5, 7, 9, 11; connect E to B or F to the middle point G of $A\,B$ and draw from points 1, 3, 5, 7, 9, lines parallel to $E\,B$ or $F\,G$, intersecting $A\,B$ at 1, 4, 9, 16, 25, 36. Project these points thus found on $A\,B$ to verticals from points 1, 4, 9, 16, 25, 36, on $A\,C$, and draw the curve (5) thru these points thus located on the verticals.

This curve can be defended on scientific grounds as embodying the laws of falling bodies (note the word gravity), such laws being applicable to bodies having a uniform acceleration and retardation due to gravitation. Kent, at page 424 of his Pocket Book, under the title "Falling Bodies," has given the formulas desired.

If g = uniform acceleration due to gravity,
v = velocity at end of t seconds,
h = total hight or space passed over in time t,
u = space for each second.
$v = g\,t$ and $h = \frac{1}{2}\,g\,t^2$.

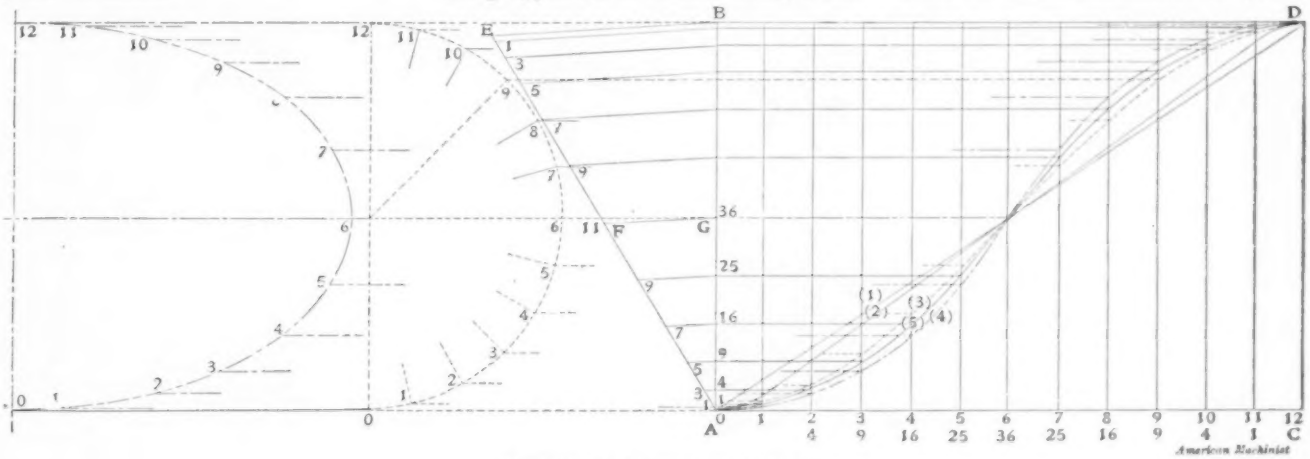
Or tabulating:

For t seconds	1	2	3	4	5	6
$g =$	1	1	1	1	1	1
$v =$	1	2	3	4	5	6
$u =$	1	3	5	7	9	11
$h =$	1	4	9	16	25	36

That is, spaces passed over in successive seconds are as the odd numbers 1, 3, 5, 7, 9, 11, etc., while the total spaces passed over from the beginning of motion are as 1, 4, 9, 16, 25, 36, etc.; that is as the squares of the times, as suggested in the formula: $h = \frac{1}{2}\,g\,t^2$.

A reference to the figure will show that in all respects our cam has been laid out to correspond to the laws of uniform acceleration and retardation, and just as a ball thrown upward will come to rest without shock, so it is reasonable to assume that a cam laid out according to the laws that apply to the ball, will cause the follower to start and stop at the ends of the path $A\,B$ with the least possible shock.

Should this explanation be helpful to any of your readers, it is well, for while the treatment may be slightly different from that already available, the material is not claimed to be new.



VARIOUS FORMS OF CAM CURVES.

Just because compression is needed, at high speeds, in these engines or in the ordinary steam engine for smooth running, may be a reason why harmonic motion is not desirable for high-speed cams, where no substitute for compression can be offered.

4. The ellipse curve (4) may be used to form the outline $A\,D$ of the cam. The construction, shown by dash and dot lines in the figure, corresponds in all respects to the layout of the harmonic curve. It should be noted that the distances 0, 1—1, 2, etc., along the ellipse outline are equal arcs. The ratio of axes of the ellipse is 1 to 1¼, chosen to correspond with the proportions used by Veteran.

It is clear that as the ratio

$$\frac{\text{major axis}}{\text{minor axis}}$$

approaches 1, the elliptical curve will approach the harmonic curve, and as the major axis is proportionally increased, the follower is started and stopped with less and less acceleration at the expense of a

* This is the curve explained by Mr. Smith in the articles now running in our pages.—ED.

on to the bearing, and the shaft is set revolving at a definite speed. The time that elapses before the shaft comes to rest is noted; the greater the time the better is the lubricating quality of the oil. After the test the bearing is cleaned by pouring over it a liquid in which the oil is soluble and then removing the liquid by a blast of air; this method of cleaning is found to be quite effective and is economical of time. The machine may be driven by an electric motor or other mechanical means or by hand, and there is an arrangement of resistance coils by which the bearing can be heated up to any required temperature. Both the bearing pressure and the speed may be conveniently regulated."

Machine for Testing Lubricating Oils.

Frank W. Mahin, United States Consul at Nottingham, Engand, calls attention in *Consular Reports* to a convenient machine for testing lubricating oils recently introduced by the Elektricitäts-Aktien-Gesellschaft, of Frankfort, Germany.

"The essential part of the apparatus is a short shaft working in a bearing and loaded appropriately. About half a pint of the oil under examination is poured

Did you ever think what a men's furnishing store the average flour mill is? Caps on the steam pipes, pants in the exhaust, collars on the shafting, ties in the packing department, pins in the crank shaft, belts on the pulleys, shoes on the grain cleaners, boots on the elevators, buttons on the electric bell systems, brushes on the purifiers, etc., etc.—*Roller Mill.*

Letters to the Editor.

Use of Practical Mechanical Suggestions.

In your editorial at page 369, "As to Contributed Articles," you say "there are many who seem to think that articles appearing in the AMERICAN MACHINIST show not only new, but the best ways of doing things" brings to my mind two incidents which show how such articles can help a man out at times. Altho in the first incident the idea was not from the AMERICAN MACHINIST, I will use it as an illustration.

TOOL FOR CUTTING KEYWAYS IN THE LATHE.

I had a long, slender shaft to cut a keyway in, and, as the keyway was quite long, and we had no good machine or method to cut it, I made a tool like the sketch, to use in the lathe in which the shaft was turned. An old machinist told me about this tool, which is set to the center of the work and drawn back and forth until the keyway is cut to the proper depth. I used a follower rest to keep the shaft from springing away from the tool. While I was doing the job, another machinist came along and asked what I was doing. I told him, and he said, "Why, I knew of that long ago; that is nothing new." While I had never seen or heard of it before I know it was quite a handy thing just at that time whether new or old, and if I had not been told about such a tool might have lost valuable time trying to fix up some other scheme to do the job.

The other incident occurred a few days ago. We had an order for 1,600 milk can handles to have four holes punched in each, making 6,400 11-32x5-16 inch deep holes to punch in malleable iron. I made an ordinary tit punch, but as our presses are for small, light work and have a very quick return, the punches would break on coming out, sticking to the iron like grim death. While trying to remove broken pieces of punch and handle from under the stripper, I thought of a letter of one of your correspondents, which said that if a punch were made slightly taper, larger at the top, it would cause the metal to expand, thereby letting the punch come out of the work easily; so I started right away and made one, and the punch did its work, and when the 6,400 holes were punched it looked as tho it was good for a couple more orders. This shows that while many people may know of ideas printed by you, there are as many, and maybe more, who do not know about them, and the idea may crop up at just the right moment to save trouble and worry.

I was very much interested in your article, "The Layout and Construction of Cams." Would it not be possible to have an article or series of articles on jigs and fixtures? as interchangeable work is getting to be more and more used.

H. H. B.

[The articles on jigs and fixtures which our correspondent asks for began to appear about the first year of the AMERICAN MACHINIST, and we expect them to continue to appear occasionally until its last year.—Ed.]

Rig for Drilling Bolt Holes in Pump Rods.

Having a large quantity of pump rods to drill as shown at Fig. 1, our usual practise had been to drill the two bolt holes and recess each end for the bolt head and nuts on a vertical drilling machine. This was a somewhat tedious method, so we made the rig shown at Fig. 2, and drilled both holes at once on a lathe, saving time and making a much more accurate job. *A* is a gray-iron bracket, planed on back, front and bottom, with a rib on the front—as shown in front elevation—to fit in the lathe bed, and locate the bracket, which is held down by two ¾-inch cap-screws, not shown. The top of the bracket is bored out exactly the same hight as the lathe center and carries the spindle *B*, which has a Morse taper bored up the front, and a spur pinion cut solid on it, as shown. The two locknuts on the back of the bracket marked *H* keep the spindle in position. *D* is the spindle (similar to *B*) which takes the place of the ordinary center, the back end being bored out and threaded to screw on the main spindle. *E* shows a groove which is used for tightening the socket on the lathe spindle. *C* is a small idler pinion which meshes with *D* and drives *B*, and runs loose on the pin on the lug on the top of the bracket *A*, as shown. The spindles *B* and *D* both rotate in the same direction and carry two ¾-inch twist drills as shown. Lubricant is supplied by a small pump, not shown, and conveyed to the drills by two small tubes. The rods were bolted on the carriage, the front end, resting on the parallel block *F*, which is held down by two bolts fastened in the T-slots. A locating stud *I* is screwed into the top of the box, on to which a loose gray-iron bushing fits, this just fits in the hole which is bored in the center of the rod end; the rod is held down by the clamp *G*. The back end of the rod rests on another block similar to *F* but smaller, this block carrying a stud also which fits in the hole marked *J* in the rod end. These two studs locate the rod in its proper position for drilling, so that it is impossible to drill them out of square. We obtained a feed of the slide of .012 inch per turn of the mill by a double quadrant and train of gears driving the back shaft; this we found satisfactory. We drilled the holes first, a ¾-inch cutter bar was then passed thru each hole and the ends faced up, as shown, for the bolt heads and nuts. We have completed a large quantity of rods by this method with boy labor and can do them much cheaper and better than on a drilling machine.

PUMP ROD.

England.

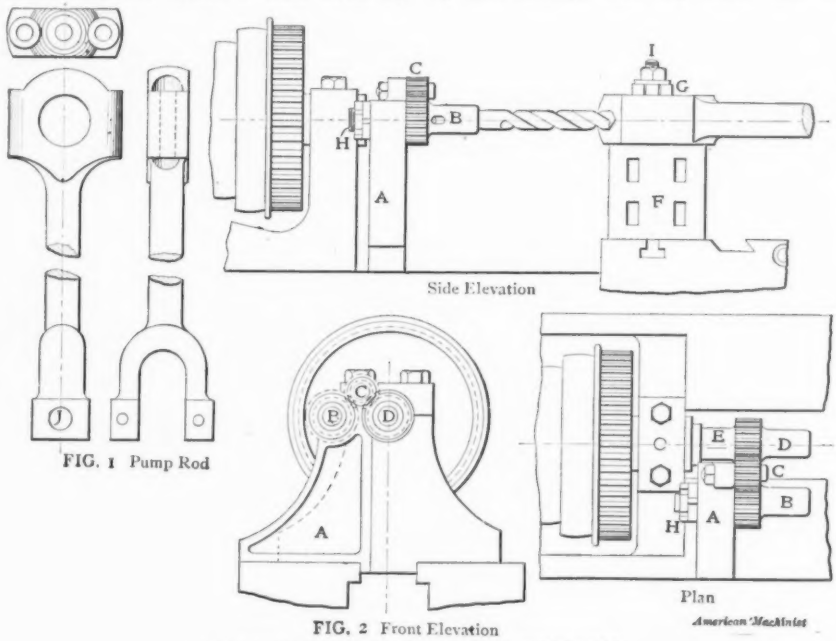


FIG. 1 Pump Rod

FIG. 2 Front Elevation

RIG FOR DRILLING BOLT HOLES IN PUMP RODS.

A Cure for the Loose Pulley Nuisance.

I notice that some of your readers are having trouble with their loose pulleys. I always like to help people out of trouble and therefore give my experience with loose pulleys, hoping it may do some little good. Five years ago we were having a great deal of trouble, caused by loose pulleys getting dry and cutting the shafts, accompanied by those noises which no good machinist can hear and not have an inclination to remedy.

When our patience was about exhausted we came across the article by E. J. Arm-

strong, at page 404, Vol. 23, entitled "A Cure for the Loose Pulley Nuisance." It looked all right and we didn't lose much time in applying the device to our worst pulley, which was 2 feet in diameter by 6 inches face. The result has been that we have never heard any grumlbing from that pulley, nor from four others to which we applied the same device. If there are any of your readers who are troubled with the loose-pulley complaint, I advise them to refer to Mr. Armstrong's article, and there they will find a sure cure. E. J. S.

Making Drawings That Will Not Be Misunderstood.

The cost of machine-shop work is very often greatly increased owing to the blindness of the drawing room to actual shop conditions. I refer to the difficulty of understanding drawings for jobs which are being taken up in the shop for the first time from new drawings. In such cases the foremen and workmen have no past experience with the work and have nothing but the drawings to guide them. Usually the drawing room has no time to make assembly drawings and only details are sent into the shop. The shop has not the faintest idea of what other pieces a given part is connected with, how it is to fit and what purpose it is to serve. They have no clue to the shape of the part except the detail drawing.

In most cases the drawing room makes a mathematically correct set of projections of the given part with barely enough dimensions to make it complete. If the shop foremen and all of the workmen were experts in reading drawings and understood every detail of the theory of projection, there would be no difficulty. However, the actual case is wholly different from this. Most machinists and patternmakers have a fair knowledge of projection, but are not experts in all its intricacies. Very often the length of a line, the existence of a fillet, the relative situation of a line on the various views, or other easily misunderstood matters are vitally necessary to give the correct shape. The matter is further complicated by the fact that the blueprint is often indistinct. Under such circumstances it is no wonder that a drawing is often read incorrectly. The remedy is to make the drawings clearer. For instance, there might be a few explanatory words stating that a given dimension was a diameter, another dimension was across flats, that such and such a distance was to fit another named piece, etc., or an extra section might be added here and there. If some such explanations were added, the average foreman and workman would much more readily comprehend what was to be done, and many minutes of anxious puzzling as well as frequent mistakes would be avoided. As every foreman knows, many a piece of work is finished up according to the shop's interpretation of a drawing, and scrapped and remade when it is found that the drawing has been misunderstood. Of course such a circumstance never reaches the ears of the drawing room or higher authorities, as it is supposed to be a mistake of the shop. Such a circumstance *is not a mistake on the part of the shop, but a mistake on the part of the drawing room.* The drawings should be made so that the average mechanic can understand them. A drawing which is absolutely correct is not enough. It must be more than correct, it must be easily understood. An example is shown by the sketches, which give an actual case. Fig. 1 shows a drawing sent to the shop. Fig. 2 shows the piece which the shop made as their understanding of the drawing. Fig. 3 shows how the drawing should have been made so that the shop could have understood it easily. In this case there is no doubt that Fig. 1 is a theoretically correct view. However, nine average machinists out of ten would have made the

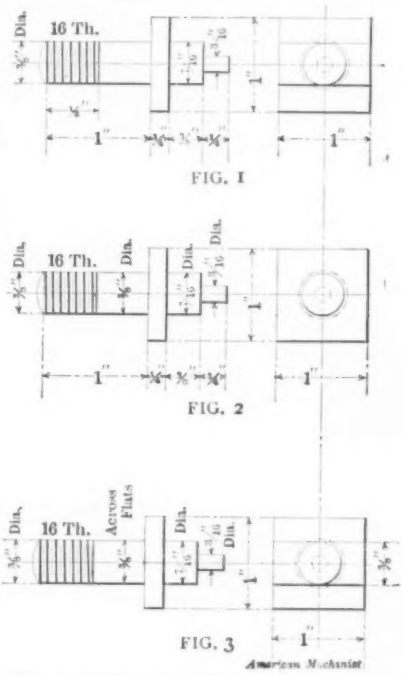


FIG. 1

FIG. 2

FIG. 3

MAKING DRAWINGS THAT WILL NOT BE MISUNDERSTOOD.

mistake. The drawing is therefore insufficient to convey the draftsman's ideas to an average mechanic and is therefore incorrect.

Owing to the great loss of time in the shop and the frequent mistakes which are made, it would certainly be a great economy to spend a little time in the drawing rooms in making details easily understood. We must therefore conclude that if a drawing is mathematically correct, but is not so made as to be easily understood, it is wrong and the drawing room is at fault and should be blamed for any mistakes or loss of time which occur.

West Lynn. S. A. Moss.

Should Engineers Interest Themselves in Sociology?

It seems to me that there are other reasons than those you name in your editorial at page 369 why engineers, as such, should take an interest in social matters.

Roughly speaking, the applied sciences are about 100 years old, and their history, like that of all new ideas, is plentifully marked with the lives of martyrs and the cumulative results of the victories of peace.

The enforcement of the social rights of Boulton and Watt not only marked the turning point in their business—the beginning of success—but it established once for all the principle that the social rights of those who have advanced the sciences are to be favored and not discriminated against, as had been the custom. There are thousands who are successful and happy, who would have been neither but for the courage and enterprise of Boulton and Watt in enforcing their rights as members of society. No one lives to himself alone, but in a measure has the rights and fortunes of others in his keeping.

"Self-love, my liege, is not so vile a sin
As self-neglecting."

When our constitution was adopted, Congress was given power to promote the progress of the useful sciences, and the branch of engineering which relates to the conducting of affairs to secure this end has been called the patent law, and has been left to lawyers who have frequently neither knowledge, character, experience, ability nor inclination in this line, while the leaders of engineering therefore complain bitterly of the misadministration of such affairs.

Surely professional pride should lead engineers to try to remedy this evil, ar when the special Court of Patent Appeals is established, the minority of the judges should be engineers of breadth of mind, learning, experience and standing in their profession.

At an early meeting of the Royal Institute there was a great public outcry because the mayor of a Scotch city so far demeaned himself as to personally welcome its members. Last year, I believe, the Prime Minister of England presided over its meeting. This change was not brought about by those who supinely neglect their social rights and those of their brethren.

The splendid achievements of the last hundred years have attracted universal public attention, and have acted as a mental and moral stimulant, till now the sciences are recognized by historians, philosophers and thinkers generally as the chief formative influence in our advancing civilization. Do these facts throw no social responsibility upon the engineer?

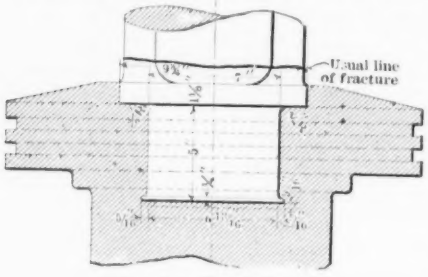
History teaches that social conditions founded upon the impulses of mankind are essentially unstable. Science is teaching men to think, to comprehend and hold in mind the certain and definite relation between cause and effect; it is slowly but consistently and durably building up a social system that shall continue to improve to the perfect day.

In "Ideals of Science and Faith," Professor Muirhead, writing on "The Psychological Approach," says: "The law of human life, so far from being a law of conservation, is a law of constantly increasing energy—of increased efficiency," and "at the end of a period of unequalled success in physical science, indeed as a last phase of it, a wider intellectual horizon is opening up." JESS.

The Ball Expansion Drive Stud.

"The Ball Expansion Drive Stud," at page 250, reminds me of a repair job I did successfully while employed by the Baldwin Locomotive Works, in Philadelphia, and which has given satisfaction up to this time. A steam hammer rod broke as shown in the illustration. As another one was needed immediately and could not be had for several weeks, I decided upon the following experiment: I placed the piston in a lathe, bored out a hole of proper taper and at the bottom cut a good, smooth groove larger in diameter than the bottom of the bore. I then turned a new rod to fit this taper when in place and cupped out the bottom, heated the piston slightly and dropped the new rod into it, placed it in the cylinder and when the cylinder head was on raised up the rod and struck it several good blows on the anvil, which expanded the cupped edge and drove it into the groove. I waited for a year and more to see where the break would occur, and when it did occur it was at about the same place the original break took place. I was gratified on boring out this stump to find that the metal had flowed up solid in the groove and held on very tight, so that we bored this out within a 1-32 before it let go The shell came out like an old tin can. Since then I have repaired and made new rods like it, always with satisfaction.

This may be new or it may not be, for



INTERNAL RIVETING JOB.

I sometimes feel that there is, nothing new under the sun. I have had recourse to this "internal riveting" a great many times, and always with success.

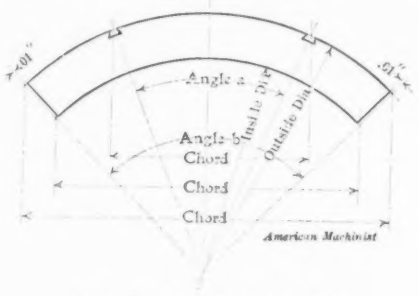
W. E. C.

[In the class of steam hammer referred to in this letter, the piston rod, piston and tail rod are supplied by the maker in one piece.—Ed.]

Making a Segment Die Without a Templet.

Some time ago you published a letter on the making of armature dies in which the writer said that the first thing to do is to make an accurate templet. Now, while a templet is no doubt very useful, and would perhaps save its cost if a large number of dies were ordered of one size and pattern, yet during several years' experience of die making I have never found it necessary to either make or use one. Apart from adding considerably to the cost of the die, the time spent in getting the templet accurate could much more profitably be spent on the die itself.

First, have patterns made for punch and



LAYING OUT A SEGMENT DIE.

die holders. Face the bases of the castings and then take the small ones to the boring mill and the larger sizes to the open-side planer. As has been suggested, an open-side planer with a radius attachment is just the thing required for this work. The next thing, as shown in the sketch, is to get the length of the chord. If not given on the drawing it can be easily worked out:

$$\text{chord} = \text{dia.} \times \sin. \frac{\text{angle}}{2}.$$

When the outer chord is so obtained, the second or inner chord is obtained by striking a line to the center. From the two chords a workman should have little difficulty in gaging his work accurately. After marking the castings the planer will machine the ends.

Next, start to build up the steel pieces. When the two end pieces are in position, take a rule that is graduated fine and measure the chord. Any toolmaker should be able to measure within .004 inch. The designer of a motor usually allows .010 inch each side for clearance, and it is never advisable to have close joints. If a close joint were made, the smallest variation in notching would make it very difficult to assemble the blanks. After the end pieces are correct, start setting out the keys or keyways to the given measurements. Since every segment die is built up of short steel pieces, start assembling the segments until the punch is complete.

I am afraid that the cost of three templets, or of even one, made in the manner that has been suggested would be prohibitive, at least for our shop. At any rate, I can assure anyone that by putting the time on the die itself instead of on the making of templets, he would get his die just as accurate and have it on the press a great deal sooner. TOOLMAKER.

Rugby, England.

Spiral Gear Calculations.

I read with interest an article on spiral gear calculations, that appeared in your columns a short time ago. To my mind the formulas are all more or less difficult to understand and are far beyond the abilities of the average draftsman. Below you will find a method I have used with good results, as it is both speedy and reliable, and working out of it only requires an elementary knowledge of practical mathematics. I have treated a pair of wheels to work at right angles and to have 45 teeth 20 degrees and 15 teeth 70 degrees, the pitch of the teeth being 8 diametral.

For reference let

A = angle tooth makes with axis of wheel,
N = normal circular pitch of 8-pitch wheel,
C = real circular pitch of spiral wheel,
L = lead of spiral per tooth,

all as shown in the illustration.

$$N = \frac{\pi}{8} = .3927,$$

And from the property of a right-angled triangle, which says that

$$\frac{\text{side } a}{\sin. A} = \frac{\text{side } b}{\sin. B} = \frac{\text{side } c}{\sin. C}$$

we get

$$\frac{.3927}{\sin. 70^\circ} = \frac{C_1}{\sin. 90^\circ}$$

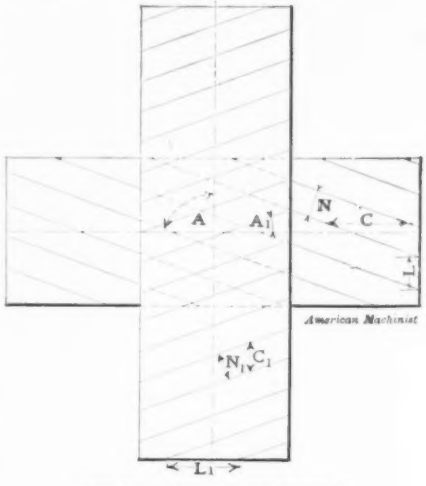
or $$C_1 = \frac{.3927 \times \sin. 90^\circ}{\sin. 70^\circ} = .4179.$$

Then

$$\frac{C_1 \times \text{No. of teeth}}{\pi} = \frac{.4179 \times 45}{\pi}$$

$= 5.985$ = diameter of pitch circle for 45 teeth, 20 degree wheel.

Also $L_1 = N_1 \text{ cosec } A_1 = 1.118.$



SPIRAL GEAR CALCULATIONS.

And for the 15-tooth, 70-degree wheel we get by the same rule:

$$\frac{.3927}{\sin. 20^\circ} = \frac{C_2}{\sin. 90^\circ}$$

or $$C_2 = \frac{.3927 \times \sin. 90^\circ}{\sin. 20^\circ} = 1.148$$

and $$\frac{C_2 \times \text{No. of teeth}}{\pi} = \frac{1.148 \times .15}{\pi}$$

$= 5.481$, which is pitch circle diameter.

And $L = N \text{ cosec } A = .4179.$

I think this is a very simple method of obtaining the pitch circle diameters.

ALFRED LAWRENCE.

Hardening and Tempering Experience

At page 297, R. B. Boone suggests an explanation for the expansion of the top and the contraction of the bottom of the die which I had given me to harden and temper, and at page 388 "Handy Man" gives his reasons which are somewhat similar to Mr. Boone's. The die was, as stated, a round die 4¼ inches outside diameter with a 3¼-inch hole (round) 1 inch in thickness used for cutting heavy paper washers. As I did not explain each operation, so that it was clearly understood, I will do so. I brought the die to an even heat, not over cherry red, and dipped it quickly and *completely*, face downward, into a bath of fresh water, from which I had previously taken the chill by dipping a piece of red-hot iron into it. Had I dipped it as they both assumed, face downward about half way, then letting bottom cool slowly until completely submerged, I would have reasoned it out as they do, but I plunged it in completely, working it slowly around until *almost* cool. I prefer to take hardened articles from the bath before they are quite cool, as I think there is then much less liability to crack. I always use a charcoal fire, and have plenty of fireworks to accompany each of my hardening operations, the firm buying the charcoal broken into small pieces and put up in bags. I generally say a few very uncomplimentary remarks concerning the same when using it, as it throws sparks to some distance around the forge, the said sparks burning just a little, and generally they alight on a tender spot, much to the amusement of the other men and boys, but I do not see the funny side of it.

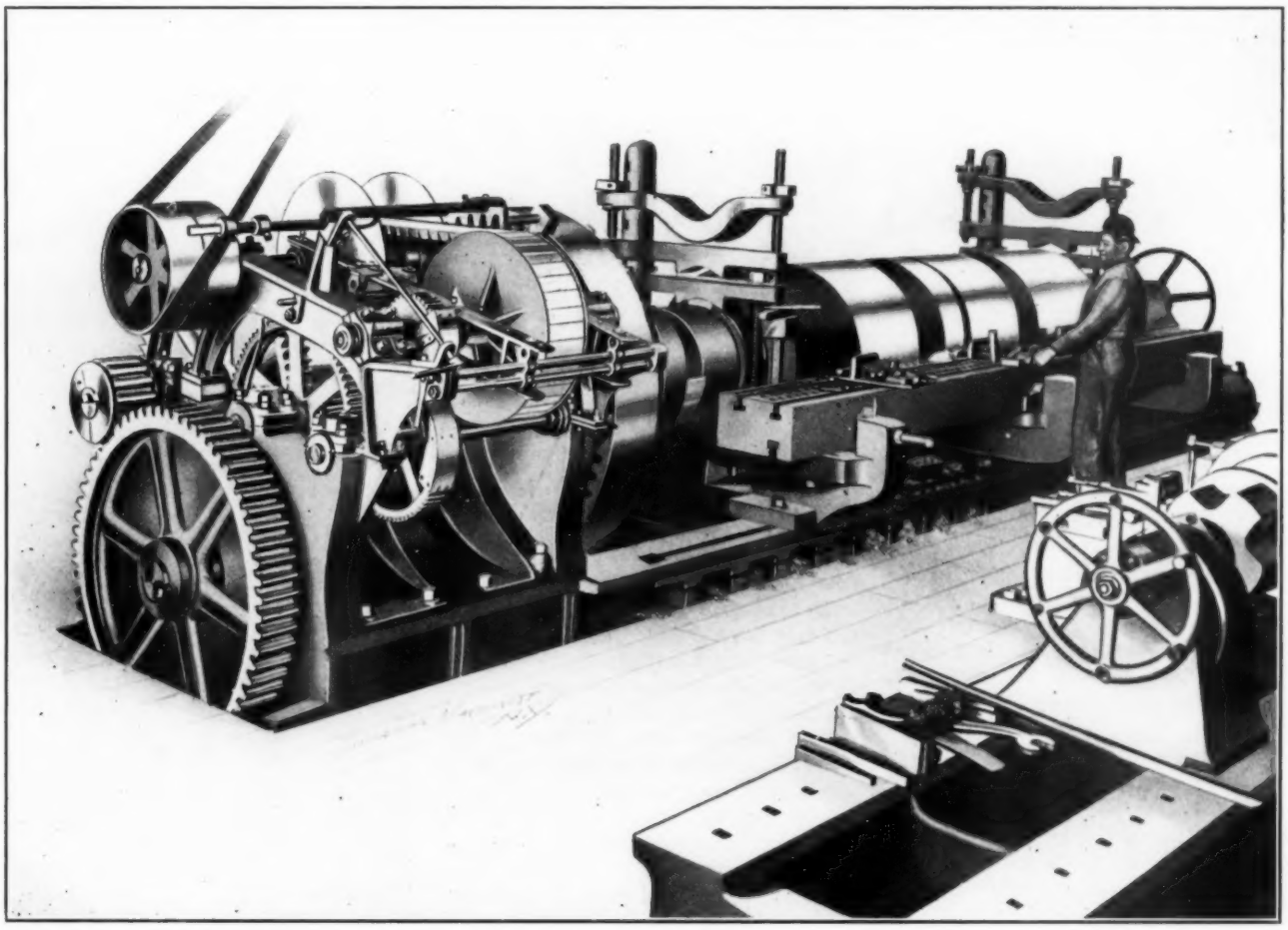
But, to come back to the die. After finding the die had hardened in such a shape, I turned one up myself and hardened it, using a piece of wire, just as "Handy Man" does, dipped it edgewise, and the die came out in good condition, allowing for regular shrinkage. I am of the opinion that when "Handy Man" used water warmed for his cutters, instead of cold water, as his Boss did, he struck the right idea, as I always have had better results on all classes of work when the chill has been taken from the bath of brine or water, but I do not advise getting it too hot, for then articles do not seem to harden as they should.

H. H. B.

Philadelphia, Pa.

Roll Lathes.

At page 114 was an article on "Roll Turning" by W. S. Standiford, with a short description of the lathe used. This lathe is somewhat different from the usual lathe for machine-shop purposes, and although many improvements have been made from time to time, more particularly in its driving mechanism, the accompanying photograph may be of interest. It shows a 60-inch roll lathe at work on a 48x152-inch chilled iron roll for a plate mill. The lathe shown was built by the United Engineering & Foundry Company, of Pittsburg, Pa. It is equipped with the Reeves variable speed drive, and three cuts each 12 inches wide are being taken. The topping device, used for matching rolls, with its adjusting screws, is above the roll being turned, and the "piano" rest with its two T-slots and the square cored holes for holding and adjusting the tools is in front. The machine is geared 202 to 1, and its approximate weight is 82,000 pounds. The floor shown is much better than is usual in mill roll shops, where plain earth is often considered good enough, and mud is not objected to.



TURNING A CHILLED ROLL 48X152 INCHES.

In Mr. Gledhill's paper on the "Development and Use of High-Speed Tool Steel," at page 47, is shown a form of tool often used in roughing, turning and for finishing chilled rolls for plate and sheet mills, etc. Formed rolls are worked out to something near the shape of the groove required, and it is then finished by forming tools of the

exact shape required. After a period of use the rolls must be dressed; this is generally done by taking them to the roll shop, but with large plate mills the rolls are often dressed without removing them from the housings, the mill being equipped with a small engine or a motor drive for the purpose. A. D. WILLIAMS, JR.

Milling Vertical Engine Frames.

I have been greatly interested in the different articles, written by practical men,

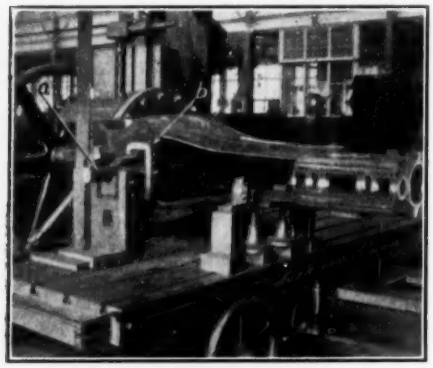


FIG. 1. MILLING THE BASE.

on machine-shop practise. Particularly have I been interested in the different methods of milling which have appeared from time to time. Having been employed on and around milling machines for the past fifteen years, perhaps I may interest some of my brother mechanics by describing a few of our methods. Our shop has been of late years converted to the milling idea, and we now look upon the milling machine as one of the most important factors in modern manufacture. From one small milling machine our shop has grown to where it keeps in the neighborhood of fifty different size milling machines in constant operation. They range

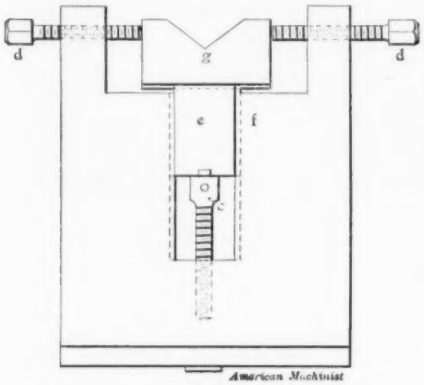


FIG. 2. ADJUSTABLE V-BLOCK.

from the little hand miller to the great 15-ton horizontal now in course of construction. I will try and explain our method of milling vertical engine frames without recourse, as formerly, to the planer or lathe.

The accompanying photographs will illustrate the different operations which each frame passes thru. Fig. 1 shows how the frame is set up for the first operation, after having been laid out and lined by a first-class machinist. An arbor *a* is inserted in the rough bearings and held in place by two special clamps *b*. The casting is then laid on its side and the ends of the arbor mounted in special V-blocks. These V-blocks, as shown in Fig. 2, have a vertical adjustment controlled by elevating screw *c*, and a horizontal adjustment by means of set-screws *d*. The vertical block *e* is tongued into the body *f* of the fixture, and the V-part *g* has a sliding dovetail fit upon the top of the block. By this means the work can be quickly and accurately alined. The business part of this operation is performed by a 25-inch inserted tooth end milling cutter the top of which is visible behind the casting in Fig. 1. This mill carries forty Novo teeth 1x¾x3 inches, which are held in place by steel wedges, driven in from the back of the cutter and pressing the teeth against a steel band shrunk on the perifery of the cutter head. This cutter removes the entire cut in one operation, taking a chip anywhere from ⅛ to ½ inch deep.

Fig. 3 shows the frame in position for the next operation. It is placed upon its milled base, with its center lines corresponding with a center line on the milling machine table. It is now ready to have the journal boxes milled out for the caps. This was originally done on the planer, but owing to the boxes coming partly inside of the frame it necessitated the use of an extension planing tool, which was a very unsatisfactory way of machining them. To obviate this a special attachment was designed, which changed a large horizontal milling machine into a vertical. It will be seen that the attachment consists of an extended casting which is shown at *h*, Fig. 4, and which is gibbed to the cross-rail of the miller and provided with a cutter spindle rotated by a train of spur gears, which are driven by bevel gears *i* mounted on the regular spindle *j* of the machine. The hub on the back of the gear is lengthened out and recessed for a bracket bearing, which extends from the side of the fixture, and holds the gear in position, when moving the fixture on cross-rail. The large bevel gear *c* is held perfectly steady as the spindle passes thru a bushed hole in the body of the attachment before passing thru the gear, thus giving a perfect bearing at the front side and another in the bracket arm at the rear. A spur gear which is fastened as in the sketch, Fig. 4, to the top hub of the bottom bevel gear meshes with the lower gear of the intermediate spindle, and the top gear of the intermediate spindle meshes with the gear on the cutter spindle. As the latter spindle is eight inches ahead of the horizontal spindle, it allows cutters to pass inside of the frame. This operation is performed by end mills in half the time taken by planing. By reason of a little stop device, no further setting is required other than the first.

The final operation is performed on a vertical miller. This part was also formerly done on a planer, but it was a trying job because of the many changes necessary to complete it. It had to be placed against an angle iron while the steam-chest and rocker box were planed, then it had to come down and be put up again at the proper angle to plane for the doors, and generally four or five changes were necessary. Fig. 5 shows how we do the work upon the vertical miller without taking down at all. The mill is shown surfacing the steam port. The steam chest and the rocker-box seat are finished at this setting; the distances from the center

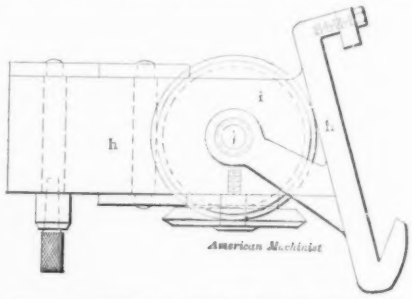


FIG. 4. VERTICAL MILLING ATTACHMENT.

being determined by special distance blocks which render measuring unnecessary. The door seats are not so plain in this photograph, but by referring to Fig. 3 one of them can be readily seen. As these door seats are on an angle, it became necessary to build an adjustable angle iron which could be set at any angle instantly. Fig. 6 shows the angle iron tilted to the right angle for milling for the doors. Now, to avoid

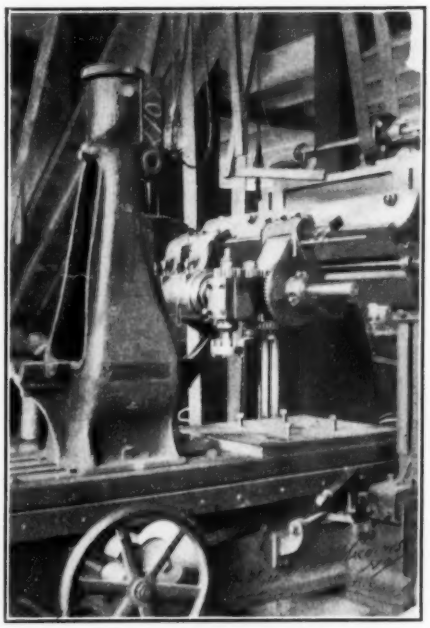


FIG. 3. MILLING SEATS FOR THE CAPS.

taking the frame down and setting it all over for the opposite side, a false face was fitted to the angle iron as in Fig. 7 and pinned thru the center in such a way that the frame being fastened to the plate could be revolved upon its axis. T-slot bolts in the plate clamped plate and angle

iron when in position. The operation was performed by end mills in one-third the time required by planing. TEXAS.

Sympathy for the "Strawboss."

At page 390 there is a "wail from the strawboss." For nearly three years I held a position which I should say was somewhat similar to his, but conditions have changed for the better in my case. I have been placed in a very peculiar position a great many times. There is no member of the firm who is a practical, or even a theoretical, machinist. The president (our Mr. Highboss) is a shoe manufacturer; the manager (our Mr. Super) was formerly a shoe manufacturer, and the other (Mr. Man) is a good traveling salesman. I think if I had come here when the shop was first started I should have had a very much better time of it. The man who was here before me was rather an "old woman" and never having had any experience in our line of business he had to learn it, as well as to make tools and fixtures for it, before he knew what he really needed. He was a very good toolmaker and a very

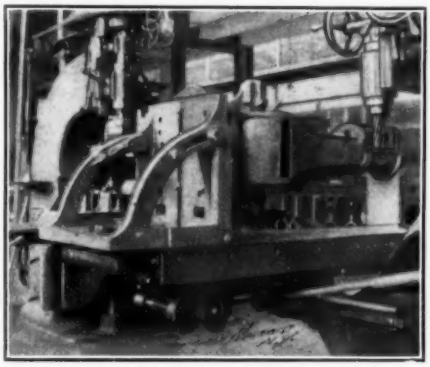


FIG. 5. VERTICAL SPINDLE MILLING OPERATIONS.

good shopmate, but he lacked the executive ability needed in a foreman. He seemed to have a little jealousy about him also, and did not like to have anyone else put the final touches on any of the work, and as he was a pretty slow workman the manager soon became impatient. Instead of removing the man he took hold to help push. He has some good ideas and is quick to see thru anything, but is not thorough in his work, and when he finds out a little seems to think he knows it all, and goes ahead, and generally brings up "in a bunch." After the other man left and they gave me the position of foreman, he troubled me a great deal by interfering with the help. He would change men on to other work or change my instructions to them without consulting me at all whenever the fancy took him. At first I used to kick some, then I got so that when he took hold of anything I simply dropped it altogether.

So it went on until one day I was fortunate enough to make an improvement in one of the tools the advantage of which was very apparent, doing it without his knowledge, as he was at home, sick. When he saw it, conditions began to improve for me right away. Since then I have discovered that the proper thing to do with him is to just go right to him and

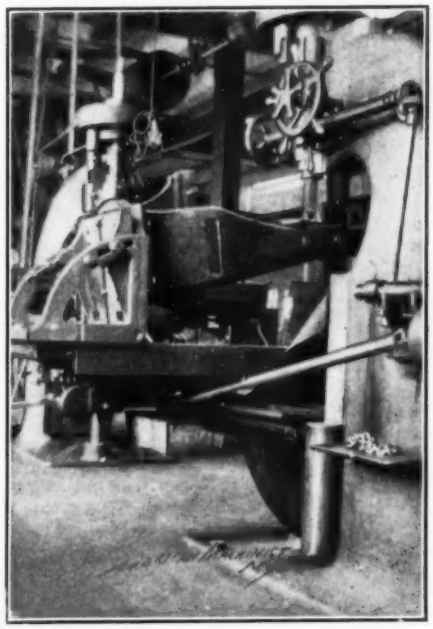


FIG. 6. MILLING DOOR SEATS.

tell him plainly what is what, which, if done in a pleasant, civil manner, seems to bring him to his senses. Perhaps if Strawboss would try this method he might improve his position.

One thing that used to trouble me as much as anything was that no matter what I recommended or advised he would take an outsider's opinion in preference to mine. We have one lathe which, so far as design goes, is one of the best on the market, but it is very poorly built, which I have always told him. Recently we have installed some new machinery, and he has made some inquiries among the ware-

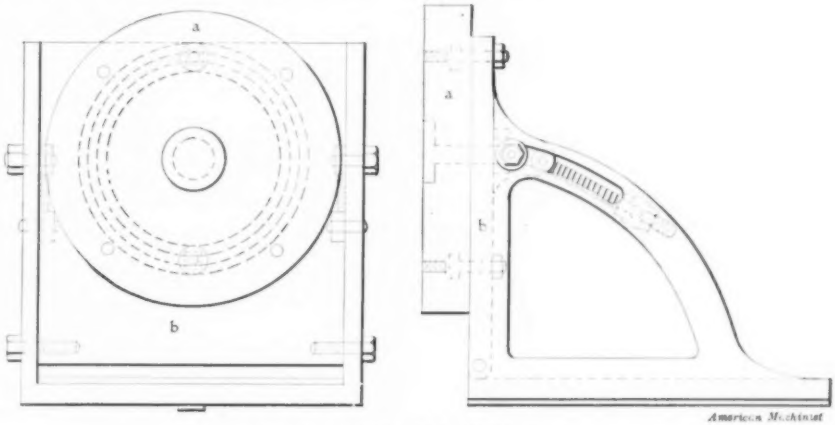


FIG. 7. ADJUSTABLE ANGLE IRON.

houses regarding the lathe of which I complained and he got the same opinion in almost the exact words that I have always given, except that I have actually shown him several places where the poor workmanship is apparent. When he told me the opinion of the other agents, I told him that whenever I expressed a positive opinion I was pretty sure of what I was talking about.

For about two years, and until recently, I have been so much dissatisfied that I have been looking for another position, realizing that it is far easier for a foreman to get a position while he has one than it is when he has none, but as conditions have improved, and are still improving, I have made up my mind to stay where I am a while longer. WARREN.

Strong Cars and Weaker Cars in Collision.

Under the above caption, at page 368, the editor mentions incidentally the possibility of having collapsible cars to ease the shock in collisions.

About twenty years ago I saw such an arrangement tested. It was, I think, in the Waverly market, Edinburgh, Scotland. The train was made up of cars—of which there were probably half a dozen—about 8 feet long. The front car was a telescoping affair with springs in it. The track was about 200 feet long and terminated in a heavy iron block. The track was on an incline, so as to give impetus to the train. The cars were loaded with all sorts of fragile stuff, such as porcelain, eggs, glass, etc. There was some sort of mechanism to hold the telescoping springs so that there would be no spring back. On striking the iron block the telescopic car absorbed the shock so thoroughly that the glass, etc., was entirely uninjured. I heard later that such a car had been built full size, but that the scheme failed, owing to lack of support from the railway companies. DIXIE.

For a Standard Size for Price Lists.

It would be a great convenience to machinery merchants and dealers if all machinery price lists were of a uniform size and some agitation of the subject in the columns of your paper would no doubt result beneficially. I attach herewith a sample page from our loose leaf price book, which is a convenient pocket size.

Some other size may, however, be found more desirable by the trade at large.

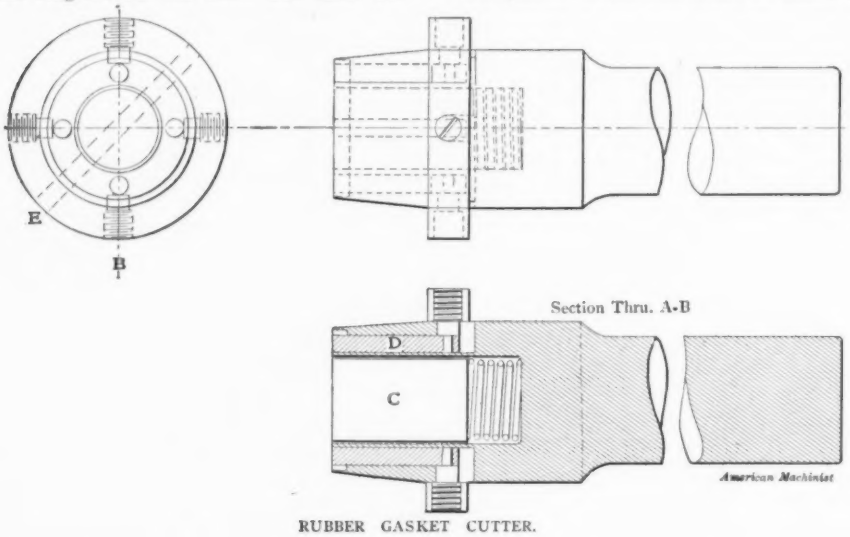
J. B. DOAN.

[It is somewhat of a coincidence that our correspondent, whose signature will be recognized as that of the general manager of the American Tool Works Company, should have written us as above simultaneously with the publication, at page 379, of our recent article on standard sizes for periodicals. A standard size for price lists and other pocket commercial matter is of course as desirable as for any other. The standard recommended below the 9x6-inch size seems to have had no general adoption and few in fact know what it is. The size of the pages referred to by Mr. Doan is 5⅞x3 5-16 inches, which seems to suggest 6x3½ inches, which would be very convenient to agree to, and which actually is the smallest of the standard sizes as originally recommended by the Master Car Builders' Association and later adopted by the engineering societies and others. Where, as in the above case, the sizes are a little below the standard size it is of course much better than where they run over the size in either dimension.—Ed.]

Rubber Gasket Cutter.

The accompanying drawing shows a rubber gasket cutter which is used in cutting gaskets for air hose connections. This tool, which is very simple in construction, was designed and made by S. S. Lightfoot, who has charge of the toolroom for the Atchison, Topeka & Santa Fé Railroad at San Bernardino, Cal.

The pin *E* fits tightly in the plug *C* and the ring *D*, but the outer and inner cutters are slotted to allow it to work up and down. It is obvious that with this construction the spring forces the gasket and the core out without loss of time.



RUBBER GASKET CUTTER.

The material used in its manufacture is tool steel throughout, with the exception of the spring, which is of brass. The blades are hardened. This tool has been in use for some time at the Santa Fé shops, and has proved very satisfactory.

G. E. B.

Cutting Circuit Breaker Clips.

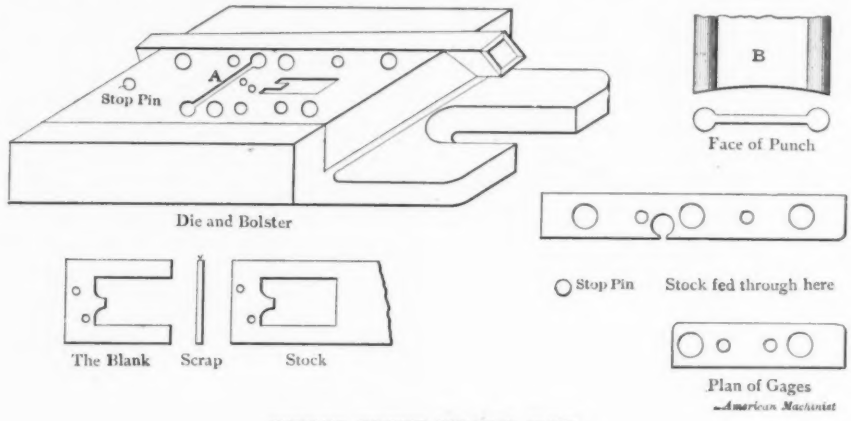
At page 369, "As to Contributed Articles," you said, among other things: "It frequently happens that a letter received describes a method of doing work which the editor who handles the letter perceives at once can be considerably improved upon. We do not consider it our duty to reject the letter because we see a better way of doing the work than that which was followed by the writer of the letter, but believe the better plan for us is to publish the letter, giving the writer of it his chance to be heard. This letter is very likely to call out from other contributors the better method or methods of doing the work."

In the same issue, at page 351, is an article by W. F. Hoffman describing a die and bender for circuit breaker clips. After reading this article, and with the above quoted words still fresh in mind, I thought I would send you the accompanying sketch which in my opinion shows a better method.

This letter is not written with any "I know it all" feeling. Perhaps some other reader will send in a still better method; and if so I shall be more than pleased.

Referring to the strip of metal shown in the sketch which accompanies Mr. Hoffman's article, it can be seen that the blank is blanked all around from the strip, leaving a 1-16 inch margin of scrap on all four sides, or, in other words, for every blank cut there is a waste of stock on three sides after the first blank is cut, which means quite an item in the cost of producing the blanks.

Referring to my sketch, the blanks are cut from the stock, which is the same width as the blank, by the cutting-off die *A*, which is made 1-16 inch longer than the width of the stock. It will be seen that there is only a waste of 1-16 inch of length of stock for each blank cut.



CUTTING CIRCUIT BREAKER CLIPS.

These tools are used on a bench power press having a very short stroke, and with an experienced operator the blanks are cut with surprising rapidity. The die requires no description, as the sketch shows all that is necessary. The punch, except the cutting-off punch, is not shown. The cutting-off punch *B* is made in the manner shown to give it sufficient strength, the round pieces at the end preventing it from springing, especially when cutting stock as thick as the punch or thicker, as is sometimes the case. When necessary the face of the punch is sheared as shown, thereby making it easier to cut.

I may say in connection with the above that on some work of a similar character the blanks are cut without wasting any of the stock, except of course the piercings, by shearing the blank from the stock.

C. F. EMERSON.

A Substitute for the Filler Quill in the Drawing Ink Bottle.

You have published a number of articles recently describing various methods and schemes for holding down the draftsman's ink bottle. The next thing of importance is getting the ink out.

The ink quill connected with the cork of the stopper in most cases gets broken or worn so as to become very unsatisfactory; then you will see the draftsman give a side glance at the stoppers in the bottles of his fellow draftsmen, paying particular attention to the condition of the quill, and it very often occurs that an exchange is made when "the other fellow" is not looking. The way I overcome this difficulty is simply by cutting off the quill

close up to the cork and substituting an Esterbrook No. 048 falcon pen. I like this arrangement very much better than the quill. P. A. P.

Provisions for Enforcing the New Trade-Mark Law.

The act of February 20, 1905, which became operative on April 1, provides substantially for the registration of foreign trade-marks on goods imported into this country, the provisions of it applying equally to Porto Rico, the Philippines, Hawaii and any other territory under the jurisdiction and control of the United States. Any domestic manufacturer or trader, and any foreign manufacturer or trader, who is entitled under the provisions of a treaty or agreement between the United States and any foreign country, to the advantages afforded by law to citizens of the United States in respect to trade-marks and commercial names, may require his name and residence and the name of the locality in which his goods are manufactured, and a copy of the certificate of registration of his trade-mark, issued in accordance with the provisions of this Act, to be recorded in the books which shall be kept for this purpose in the Department of the Treasury, and may furnish the department fac-similes of his name, the name of the locality in which his goods are manufactured, or of his registered trade-mark; and the Secretary shall cause one or more copies of the same to be transmitted to each collector or other proper officer of customs. Manufacturers and traders located in foreign countries, which, by treaty stipulations, give similar privileges to the United States, are given the same advantages as are to be given to domestic manufacturers and traders.

Domestic manufacturers and traders, and foreign manufacturers and traders, to avail themselves of the privileges of the act, so far as concerns trade-marks, are required to register their trade-marks with the Commissioner of Patents before the Treasury Department can act.

Applications for recording the names and trade-marks will state the name of the owner, his residence and the locality in which his goods were manufactured, and in the case of trade-marks shall be accompanied with a certified copy of the certificate of registration of his trade-mark and the names of the ports to which fac-similes should be sent. In case of the name of a domestic manufacturer or trader (not registered as a trade-mark in the Patent Office) the application must be accompanied by the proper proof of ownership and proof as to the country or locality in which his goods were manufactured.

On the receipt by a customs officer of any such fac-simile, with information from the department that they have been recorded, he will properly record and file them, and will exercise care to prevent the entry at the custom-house of any article of foreign manufacture copying or simulating such mark. No fees are charged for recording trade-marks in the Treasury Department and custom-houses.

A sufficient number of fac-similes should be forwarded to enable the department to send one copy to each port named in the application, with ten additional copies for the files of the department.

Especially is attention called to the provision in the act prohibiting the entry of articles "which shall bear a name or mark calculated to induce the public to believe that the article is manufactured in the United States, or that it is manufactured in any foreign country or locality other than that in which it is in fact manufactured, and collectors and other officers of the customs have been instructed to use due diligence to prevent violations of this provision. A. F. T.

Machinery and Tools for Panama Canal.

The attention of machinery manufacturers is invited to the fact that the Isthmian Canal Commission is inviting sealed proposals until May 1, for furnishing a large quantity of machinery, drills, lathes, saws, steam hammers, boring machines, planers, pneumatic machinery, etc., delivered at either Colon or La Boca, Isthmus of Panama. The quantities may be increased not to exceed 20 per cent. Each set of bids for machinery should be accompanied by full specifications and detailed drawings, in quadruplicate. Intending bidders can procure proposal blanks and full information on application to Major H. J. Gallagher, United States Army, purchasing agent, Washington, D. C.; assistant purchasing agent, 24 State street, New York city, or the assistant purchasing agent, Custom House, New Orleans.

Catalog of the German Exhibit at St. Louis.

An indication of the thoroughness with which the German nation is looking after its commercial and industrial interests is illustrated by the official catalog of the exhibition of the German Empire at the International Exposition at St. Louis in 1904, the English edition of which we have recently received. Besides being a beautiful example of the bookmaker's art, this catalog is one well calculated to be of much use to those who may be interested in the things of which it treats. Besides being a catalog of the exhibits proper, there is a great variety of introductory articles, written by men of prominence in their several professions, on business, industrial and economic conditions in Germany, and giving statistical and historical data, etc. These articles, as well as the list of manufacturers and other things to be found in the book, are likely to be very useful in various ways to manufacturers and engineers. The copy we have comes from the Imperial German Consulate General, Post Office Box 658, New York city; the Acting German Consul General informing us that the consulate has on hand a limited number of copies of the catalog for free distribution on written applications; express charges, however, to be borne by the recipient.

High Record Iron and Steel Exports —Machinery the Leading Item.

The reports of the Department of Commerce and Labor for the first eight months of the current fiscal year show that the exports of iron and steel manufactures from the United States exceed those for any previous corresponding period. The high record made in the first eight months of 1901 was 81½ millions, while for the same period of the present fiscal year the amount is 85½ millions. Machinery, now the leading item of export in the iron and steel schedule, has increased from $5,487,640 in the first eight months of 1885 to $39,066,052 in the corresponding months of the present fiscal year. Under the head of machinery are included locomotives, in which the growth was from $655,096 in 1885 to $1,946,420 in 1905; printing presses, from $116,142 to $874,139; sewing machines, from $1,948,491 to $3,809,694; and in addition many other articles which were not enumerated in 1885, such as cash registers, electrical machinery, laundry machinery, typewriters and other items representing lines of industry which have only developed in recent years. Steel rails have also increased in exports from $177,465 in the first eight months of 1885 to $8,000,649 in 1905 to date, and over half of the latter value represents shipments to the rapidly developing sections of Canada, while Japan almost equals Europe as a market for American rails, being credited with $431,304 worth as against $529,839 for Europe as a whole.

The following table shows the imports and exports of iron and steel manufactures in 1885, 1890 and annually from 1895 to 1905, the figures in each case being for the first eight months of the fiscal years named:

Eight Months ending with Feb.—	Imports of Iron and Steel.	Exports of Iron and Steel Manufactures.
1885	$23,007,651	$11,541,505
1890	26,066,085	16,735,594
1895	15,288,485	20,589,340
1896	18,135,334	25,721,986
1897	10,517,588	35,781,809
1898	8,207,977	42,864,262
1899	7,565,565	58,377,784
1900	12,949,157	75,053,768
1901	12,279,674	81,575,685
1902	15,727,932	64,675,523
1903	34,558,900	62,922,173
1904	19,447,258	67,886,083
1905	14,343,904	85,546,682

Seven hundred carloads of steel for the new bridge across the St. Lawrence at Quebec are ready at the Phœnix Iron Works, Phenixville, Pa.

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For a Standard Price Sheet.

We have received from a well-known firm of machinery dealers a letter from which we quote as follows:

"The dealers of the country are agitating the subject of a standard or uniform price sheet and several have already addressed letters to the different manufacturers in our line of business. A word in your paper on the subject might help matters along. You succeeded in making a standard catalog possible, and why not a price sheet?

"Arguments in favor of the standard printed sheets issued directly by the manufacturers are so patent as hardly to require mention at length.

"First—Elimination of error incident in copying or abbreviations made in attempts to economize space.

"Second—Elimination of delay in copying prices. It frequently happens that prices on several lines of machines are changed simultaneously. Delay, under these circumstances, in entering new prices in salesmen's price books is almost unavoidable.

"Third—Compactness and convenience. Standard price sheets would furnish salesmen the means of complete and ready reference, which often are most essential factors in determining the success or failure of an attempted sale. In connection with this, manufacturers who issue stock lists from time to time could use the same size sheet. It could be bound in a loose-leaf book, and, in connection with data sheets, would place in the salesman's hands all information concerning his line, and thus enable him to push his sales without taking time to communicate with the factory or his own office.

"Anything you can do to help this good cause along will add more laurels to your already full crown and win the thanks of many dealers and salesmen all over the country."

Of course no reader of the AMERICAN MACHINIST needs to be reminded that we favor standards and believe they ought to be adopted so far as possible wherever their use will help in eliminating needless bother and expense in manufacturing or commercial operations.

If there are any considerable number of machinery dealers who believe as our friends do that a standard price sheet would be an advantage, then such a standard should be formed. The presentation, discussion and, if thought wise, the adoption of such a standard ought to be a proper function of the newly organized dealers' association. Also, if anyone interested cares to get up such a standard sheet and submit it to us, we shall be glad to publish it and to invite discussion upon it, to the end that manufacturers and dealers may be enabled to get together in this matter. A manufacturer also gives his views elsewhere in this issue. We invite others to do the same.

The Best Protection for Steel Structures—An Important Discovery.

The Pennsylvania Railroad has spent $5,000 a year for painting its terminal station at Jersey City, and the results have been anything but satisfactory. Louis H. Barker, now assistant chief engineer, has been for years conducting a series of tests of paints, trying all which gave any promise of success and all have failed. An elaborate table has been published showing the experiments that have been tried in the past ten years and as the result not one of the paints protected the surface more than eight months, while some of them failed in a month. It was found that no oil paint can ever be made waterproof. Little blisters, almost infinitesimal, begin to appear on the surface painted before any actual scaling is discovered. From this it was inferred that the best cleaning possible still leaves minute points of rust which after being covered with paint absorb moisture thru the paint and form new rust centers. It was thought that if a covering could be found which would absolutely shut off all moisture no rusting would take place. This material has been found in paraffin paper. The surface is covered with a single coat of very sticky covering and thin paraffin paper is pasted upon this very much as wall paper is applied. This is painted with any pigment or color desired, and that is all. Rivets are covered with little shaped cups of the same paper. The paint applied over the paper remains in good condition and does not flake off. Much study and experiment have been employed in the selection of the best adhesive compound, and this seems to be now determined. When the paper has been put on, it may be painted at once, so that the process is a quick one and the range of its application is evident. This method of steel protection has been tried in other and even more trying positions than upon the train shed at Jersey City and always with most satisfactory results.

Atmospheric Humidity.

Increased attention is being given, and very properly, to means for controlling the humidity of the atmosphere both in dwellings and in factories and other places where many people are congregated for large portions of the day. With the means employed for the necessary heating of buildings in winter, the tendency is almost invariably to overdry the atmosphere. Professor Carpenter at Cornell University found the air in his house as dry as that of the Desert of Sahara. The frosted windows which once were the delight of children, from one to ninety, have disappeared with the stoves and the open fires. Not only comfort but health also is promoted by increased humidity up to a certain point. Dr. Henry Mitchell Smith, in a paper before the Brooklyn Medical Society, tells of some tests made by him with an experimental air moistening apparatus

in connection with a steam radiator. With a relative humidity between 50 and 70 per cent. an air temperature of 70 degrees Fahr. was uncomfortably hot, 68 degrees was warm and 65 degrees comfortable. The most comfortable conditions were found with a temperature of 65 to 68 degrees and 60 per cent. humidity, this showing a marked contrast to a temperature of 72 degrees and a relative humidity of 30 per cent. The former felt warm and balmy, and the latter chilly and dry and giving an impression of draftiness. Comfort and discomfort, also health and sickness, are thus dependent upon conditions which should be rather minutely and carefully adjusted, but such adjustment will prove highly beneficial. It would be well if means could be devised for correcting the excess of humidity which causes such discomfort in the summer months. This would seem to be more difficult, but not less desirable, than the moistening of the air which is artificially dried in winter.

Taxing Coal Production.

The Engineering and Mining Journal very properly criticises Governor Pennypacker's law which has been under consideration by the Pennsylvania legislature and under which it is proposed to place a uniform tax upon every ton of coal mined in the State.

As our contemporary truly says, this tax is opposed to every true principle of economics. It would tend to restrict the production and use of coal by increasing its cost to consumers; thus working a double injury and placing an additional burden upon those least able to bear it. It is a proposition to tax industry, production and business and is vicious in principle.

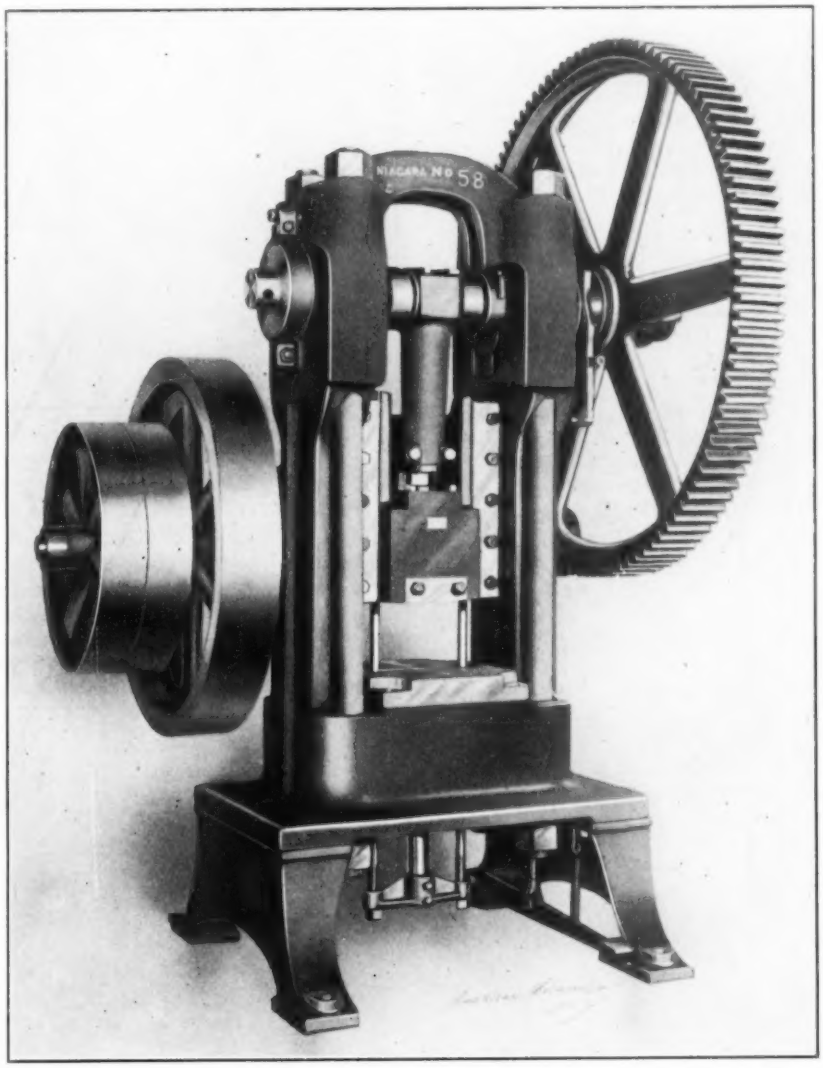
Only a very small part of the coal lands of Pennsylvania are being mined by the trust. The rest is merely held out of use to prevent competition by those who might otherwise invest their capital, buy machinery and employ labor in competition with the coal trust. If this untouched coal land thus held out of use for the purpose of maintaining a monopoly injurious to business and manufacturing interests were to be assessed and taxed at something like its real value, the State of Pennsylvania would derive a far greater revenue from it than from the proposed tax on coal, and the effect of such a tax would be to bring more coal land into active use, to reduce instead of increase the price of coal and to benefit instead of injure business and manufacturing interests, as well as private consumers.

Referring to the illustration at page 333 of an electric fixture especially for shop use, M. A. Herold, of Milwaukee, Wis., calls our attention to the fact that an American patent has been granted to him for a similar device, and that it is manufactured for the market in various styles.

New Tools and Machine Shop Appliances.

A NEW POWER PRESS.

The half-tone shows a straight side power press designed for heavy embossing, forming and punching automobile parts, trimming drop-forge work, etc. The frame of the press is a single casting with four 3½-inch steel tie rods shrunk into place to take the tensile stresses. The distance between the uprights is 22 inches, and from the bed to the bottom of the slide at the highest point of stroke and adjustment is 11 inches. The press can be furnished with a stroke up to 8 inches. The hammered steel crankshaft is 6¼ inches in diameter and its strongest place is in the crank-pin. The slide has long guides with V-gibs. A ball and socket connection is used and the adjustment cannot become unlocked while the press is running. A positive clutch is used with a positive stop which causes the crank to stop at the highest point of each revolution whether the treadle is depressed or not. The press must be started anew for each stroke unless the positive stop device is disengaged, which can be easily done. The ratio of pinion and gear is 1 : 7¾. There is a knockout attachment below the bed for ejecting work formed in the lower die. This press is designated as No. 58 Special. It is built by the Niagara Machine Tool Works, Buffalo, N. Y.



A NEW POWER PRESS.

A QUICK-CHANGE MICROMETER AND A CENTERING TOOL.

Fig. 1 shows the main features of a quick-change micrometer, and Fig. 2 a centering device for round or square stock. Both of these tools were brought to our office by the inventor for inspection.

At *A*, Fig. 1, is shown the part which takes the place of the solid screw in the regulation micrometer. This is a shell having a short thread cut on the outside and a cam with four lobes on the inside. Within this shell is placed the four-lobed external cam *D*, Fig. 1. It is obvious if *D* be turned so that the lands on it come opposite the lands on the internal cam *A*, the threaded part of *A* will be expanded

so as to fit the long nut in the micrometer hub. If, on the other hand, the lands on *D* be turned to a position opposite the grooves in the internal cam in *A*, then the threaded part of *A* will contract, permitting it to be slid to any desired position in the long nut in the micrometer hubs. The accuracy of this tool depends of course upon the thread in the hub. By this construction the caliper may be opened or closed instantly close to the desired size

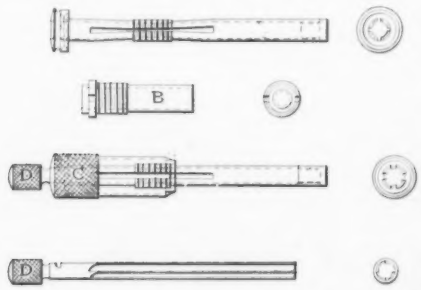


FIG. 1. QUICK-CHANGE MICROMETER.

and then a few turns of the screw give the exact setting.

Fig. 2 shows the centering tool. The body of the tool *E* is provided with slots in which the four racks *G* work. The ends of these racks are provided with jaws *F* which center the tool on the bar of stock. In the center of the tool is mounted the

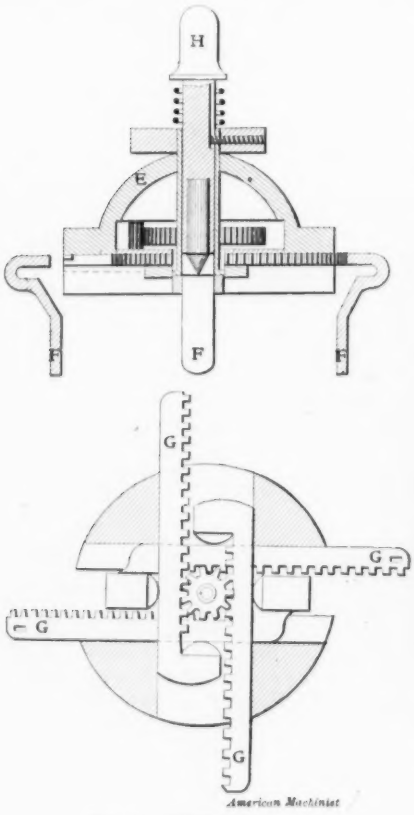


FIG. 2. CENTERING TOOL.

spindle *H* which has a center punch at one end. Outside the spindle *H* is a sleeve with a nurled head; at the other end of this sleeve is a pinion which engages with the racks *G* and moves them to or from the center in unison, and a spring is provided which closes the device automatically.

The inventor of these tools is C. A. Fisk, 161 East Twenty-seventh street, New York.

A NEW CORE OVEN.

The core oven here shown is semicircular in section, the front being flat when all the sections are closed. Fig. 1 shows the upper section swung open, the next two closed, and the lower two open. Either section may be opened independently of all the rest, and for cores too high for any section the shelves of sections above may be lifted out and the combined sections can be used as one. The furnace is seen in Fig. 2, below the middle of the circular part, and a short stove pipe projects from the top. The furnace is brick lined. The oven here shown is 6 feet high and 6 feet across the flat side. It is substantially made and is giving good satisfaction in use. It is known as the Wills core oven and is built in different sizes by E. Cooper Wills, Trenton, N. J.

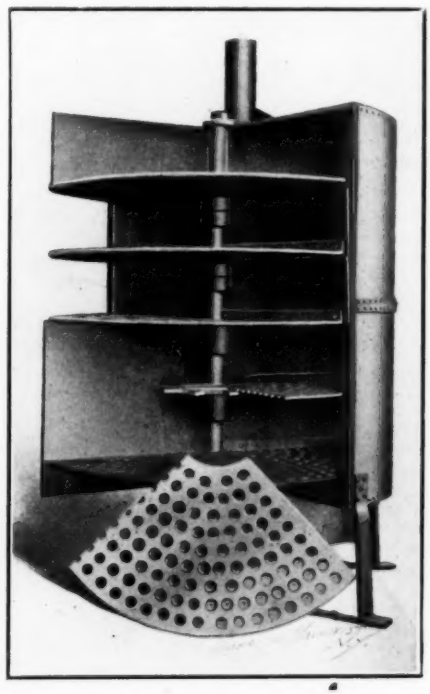


FIG. 1. FRONT OF CORE OVEN.

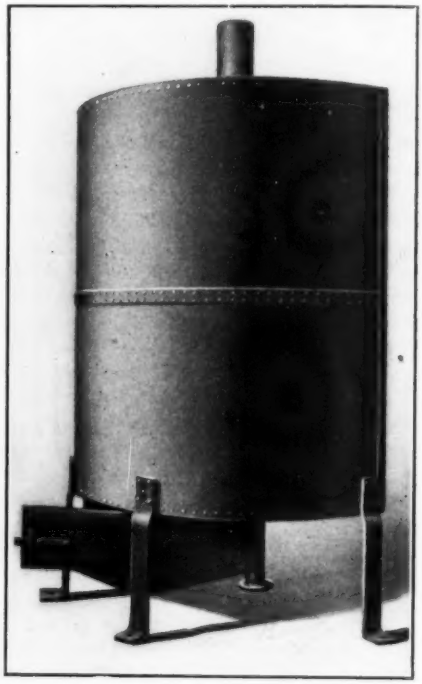
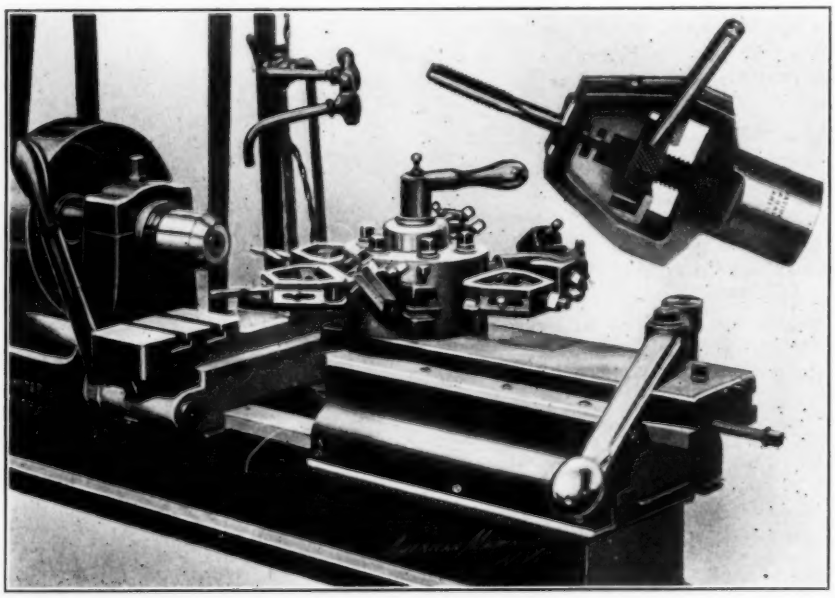


FIG. 2. BACK OF CORE OVEN.

TURRET HEAD DRILL CHUCK.

The illustration shows a new chuck which has been designed for use in turret heads. The shanks of these chucks are made to fit the hole in the turret, and are turned very close to the body of the chuck to avoid overhang. The open construction permits dirt and chips to drop out. Owing



TURRET HEAD DRILL CHUCK.

to the convenient position of the adjusting screw, tools may be readily changed. The adjusting screw is provided with a slot into which the flattened end of the drill or other tool fits, thus giving a positive drive. Taper jaws to fit Morse taper shanks are also supplied. For holding taps both while cutting and reversing, a square block—into which the squared end of the tap fits—is held in the back end of the jaws which grasp the shank of the tap. The chuck is made by the Oneida National Chuck Company, Oneida, N. Y.

TAPS WITH INSERTED BLADES.

The taps illustrated in the half-tone and line cuts were designed specially for use in a Becker tapping machine. The body and the shank are one forging. The blades —of special steel—are driven into slots up against a shoulder at the top—see Fig 1. The drive of these taps is very powerful, the taper shank fits the spindle and a key bears on the flat surface milled on the side of the taper; further, the end of the machine spindle is milled to fit the rectangular block at the bottom of the taper—see Fig. 2.

These taps are made in sizes from 3 to 12 inches by W. H. Nicholson & Co., Wilkesbarre, Pa.

Arthur P. Greeley, of Washington, D. C., member of the Patent Law Association, member of the commission to revise the patent and trade-mark law, member of the American Bar Association, and formerly Assistant Commissioner of Patents, is the author of a pamphlet published by John Byrne & Co., of Washington, D. C., in which is treated the subject of registration of trade-marks under the new Trade-Mark Act, and those of our readers who may desire information regarding this new law will find a great deal of information pertaining to it in this pamphlet.

The *Engineering News*, of New York, offers prizes amounting to $350 for the best papers on the manufacture of concrete blocks and their use in building construction.

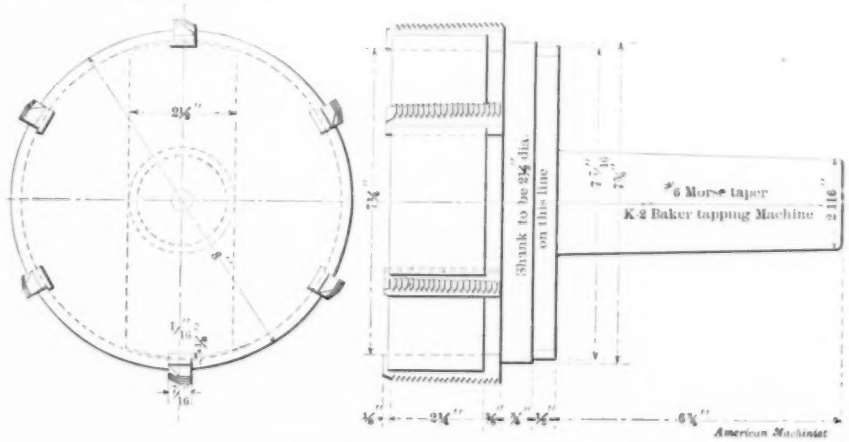


FIG. 1. EIGHT-INCH INSERTED CUTTER PIPE TAP.

New Publications.

"Gas Engines and Producer Gas Plants." By R. E. Mathot. Translated from the French by W. B. Kaempffert. 314 6x9-inch pages, with 152 illustrations. Norman W. Henley Publishing Company, New York. Price $2.50.

This is a non-mathematical descriptive treatise on gas engines and gas producers intended as a guide for the designer and user in the construction, selection, installation and operation of gas engines and producer gas plants. The functions and construction of the various parts are discussed clearly and simply. Nearly one-half of the book is devoted to producer gas, producers and accessories. Many producers are illustrated and described, all we believe of European origin, and this part of the book will be found of especial value to American readers, as comparatively little has been done in this field in this country.

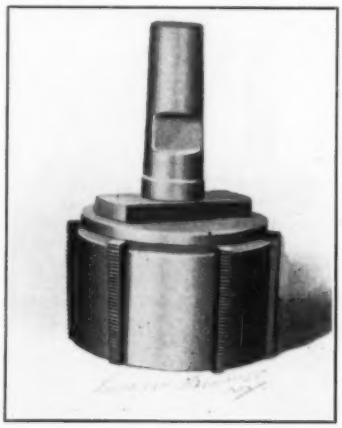


FIG. 2. INSERTED CUTTER PIPE TAP.

"Elements of Mechanics." By Mansfield Merriman. 172 4¾x7¼-inch pages with 143 illustrations. John Wiley & Sons, New York. Price $1.

The author of this book considers that students in engineering should have the elements of mechanics presented to them during their first year and preceding the more elaborate study of the subject, after the calculus has been taken up and its methods made available. The book has been written mainly for this purpose, but others than students in engineering will find it an excellent outline of the subject. The mathematics is very simple, involving only plane geometry, elementary algebra and plane trigonometry. The subjects discussed are the composition and resolution of forces, the center of gravity, resistance and work, simple machines, by which is meant what used to be called the mechanical powers, gravity and motion, inertia and rotation. The whole is divided into seven chapters and forty lessons. Those who are able to read mathematics of the character described will be able to obtain from the book an excellent groundwork in the subject covered by it.

"English and American Steam Carriages and Traction Engines." By William Fletcher. 428 5¾x9¼-inch pages with 250 illustrations. Longmans, Green & Co., London, New York and Bombay. Price $5.00.

This book does not relate to automobiles as that term is now understood, but to traction engines designed to draw other vehicles behind them, those vehicles being, however, in some cases intended for the transportation of passengers. It forms an excellent *résumé* of existing practise in this field of work, and is both a treatise and a collection of comparative descriptions. This field has been much more fully cultivated in England than in this country, and the bulk of the book relates to English machines, altho very full and explicit descriptions and illustrations of the leading makes of American traction engines are given. Most of these are of the agricultural class, and are intended chiefly for driving threshing machines, and also to act as motive power in drawing them from place to place. The author is quite impartial in comparing the products of the two countries, finding some things to admire and others to condemn in American practise.

"The Steam Engine and Other Steam Motors." Vol. 1. By Robert C. H. Heck. 391 6x9-inch pages with 190 illustrations. D. Van Nostrand Company, New York. Price $3.50.

This book is a complete treatise upon the steam engine, intended for the use of students in engineering, the author being a professor at Lehigh University. The present volume treats of the theory of the steam engine, including elementary thermodynamics, the action of steam in the engine, the dynamics of steam, the entropy-temperature diagram and the mechanics of the engine, the latter term meaning the forces at work in the engine and the kinematics of the movements. The second volume, which is in press, will cover the form, construction and working of the engine and steam turbines. The entire work is a thoroughly scientific, and not unduly mathematical discussion of the steam engine.

"Development of the Lake Superior Copper Mines During 1904." By Arthur L. Carnahan. 37 6x10-inch pages. Published by the author, Calumet, Mich. Price 50 cents.

This pamphlet takes up practically all of the copper properties of Northern Michigan and describes the extent to which their development has been pushed during the past year, including also a statement of the machinery equipment in each case.

"How to Mix Paints." By C. Godfrey. 64 5x7½-inch pages, with six illustrations. The Industrial Publication Company, New York. Price 50 cents.

This very useful little volume is intended more especially for those who occasionally have painting to do, rather than for those who follow the painter's trade. The principal colors in ordinary use have been selected and instructions are given for mixing them so as to produce a large variety of tints and shades. A chapter on color harmony contains useful hints on the various colors that may be used in combination.

"The Model Locomotive." By Henry Greenly. 276 5½x8½-inch pages with 371 text cuts and 10 folded plates of drawings. Percival Marshall & Co., London. Price 6 shillings.

This book is another striking illustration of the activity and the serious nature of the work undertaken by the English amateur mechanic. It is a serious treatise upon the construction of model or toy locomotives, the machines shown being by no means merely reduced copies of larger engines, but independent designs based upon a study of the first principles of the work to be done. We have nothing in this country worthy to compare with it in any field of amateur work, and no one can read the book or even glance thru it without an increased respect for the English amateur mechanic. The book is embellished with a number of half-tone illustrations of completed engines and of their various parts. The text illustrations are chiefly working drawings, duly dimensioned, of the various parts, and appended to the book is a series of plates forming the complete set of working drawings of one of the engines.

The recently enacted new law on trademarks has stimulated the production of a number of books designed to throw light on this subject, written mostly, and naturally, by lawyers who are engaged in the practise of patents and trade-marks. The latest to come to hand is published by Griffin & Bernhard, attorneys and counsellors, at 277 Broadway, New York, and is written with particular reference to the registration of trade-marks under the new law referred to.

The United States Civil Service Commission announces an examination on May 17, 1905, to secure eligibles from which to make certification to fill a vacancy in the position of engineer of timber tests (male) in the Bureau of Forestry, Department of Agriculture, at $1,000 per annum, and vacancies as they may occur in any branch of the service requiring similar qualifications. This examination is open to all citizens of the United States who comply with the requirements. Applicants should at once apply either to the United States Civil Service Commission, Washington, D. C., or to the secretary of the board of examiners at various designated places in the several States.

Personal.

E. W. Saunders, who is quite well known in connection with the machine-tool trade in New York city, having been connected with prominent machinery dealers' establishments, is now with the H. A. Rogers Company, of 19 John street, New York.

Charles A. G. Winter, who has for four years past been general superintendent of the works of the Chapman Valve Manufacturing Company at Indian Orchard, Mass., severed his connection on April 1. He was given an elaborate dinner by friends and employees.

Richard Devens, who has for some years been connected with the European office of the Brown Hoisting Machinery Company, Cleveland, Ohio, has been appointed manager of their New York office, 26 Cortlandt street, to succeed W. A. Stadelman, who has resigned.

A. C. Bunker and W. C. Appleton have become associated with the Crocker-Wheeler Company, Ampere, N. J., in the engineering and contract departments, respectively. Mr. Bunker has been connected with the Stanley Electric Manufacturing Company on the Pacific coast. Mr. Appleton has acted as engineering salesman for the General Electric Company in the Atlanta territory.

Obituary.

Captain Henry B. Nones, retired, U. S. Navy, died at Wilmington, Del., April 9, seventy-four years old. He was appointed third assistant engineer in the navy in 1852. In 1863 he became fleet engineer, chief enginer in 1864, and was retired in 1892.

George W. Stafford, builder of textile machinery, died at Long Meadow, R. I., March 30, fifty-five years old. He organized the George W. Stafford Manufacturing Company, which was consolidated with the Crompton & Knowles Loom Works several years ago, Mr. Stafford remaining as general manager of the Providence plant of that company until three years ago, when he organized another company bearing his name at Readville, Mass.

The John Fritz Medal, established by the professional friends of John Fritz in 1902, has been awarded for the first time, the recipient being Lord Kelvin. The award is made by a committee of four representatives from each of the American engineering societies. The medal is awarded to Lord Kelvin for "Cable Telegraphy and Other General Scientific Achievements." Lord Kelvin has within a few days undergone a serious operation and the reports of his condition are not encouraging.

At a meeting of the Milled Screw Manufacturers held in New York on March 31, a new list was adopted which equalizes the inequalities of the former cap- and set-screw lists. On account of the very small quantity of square-head cap-screws consumed, it was found desirable to abandon the old list on this line, and hereafter square-head cap-screws will be sold from the list and at the prices prevailing on hexagon-head cap-screws.

Dr. Richard Moldenke, secretary of the American Foundrymen's Association, has sent out the preliminary announcement of the eighth annual convention of the association, which will be held in New York June 6, 7, 8, and possibly 9, 1905. Headquarters, hotel accommodations, reduced railroad rates, etc., are being arranged for. The indications are for a very large attendance. Special pains will be taken to care for the ladies and they are cordially invited. They have been quite numerous at previous meetings. The address of the secretary is Watchung, N. J.

Business Items.

The Carlyle-Johnson Company, of Hartford, Conn., manufacturer of the Johnson friction clutches and marine reverse gears, is adding 4,000 square feet floor space and a number of machine tools to its present plant.

The Jacobs Manufacturing Company, of Hartford, Conn., manufacturer of Jacobs Improved Drill Chucks, has been compelled to enlarge its shops and install a number of additional machines because of the increased volume of business.

The Bates Machine Company, with main offices at 346 Broadway, New York, has recently established a branch office in the Manhattan Building, 315 Dearborn street, Chicago. This office will be in charge of C. K. Eberts, formerly with Barnhart Bros. & Spindler. The Bates Company is a large manufacturer of standard models of hand and typographic numbering and dating machines.

The Bullard Automatic Wrench Company, of Providence, R. I., manufacturer of the new Bullard combination nut, pipe and ratchet wrench, has just moved into its new factory at 257 West Exchange street, Providence, and it will have its offices located at the same place. It states that it is now prepared to furnish these wrenches in quantities and fill orders promptly.

The Trinity Building, 111 Broadway, one of the largest and most modern buildings in New York city, will be ready for occupancy about May 1. The National Electric Company, Milwaukee, Wis., manufacturer of Christensen air brakes and electrical machinery, will move into a new suite of offices on the twelfth floor of this building, its present quarters at 135 Broadway being too small to accommodate its increased sales organization.

The Niles-Bement-Pond Company has leased an entire floor in the Trinity Building, New York, and will be located there after May 1. As is well known, the executive offices have been located in New York since the organization of the company under its present title. The Niles-Bement-Pond Company employs about 5,000 workmen, and has two factories in Philadelphia, one in Hamilton, Ohio; one in Plainfield, N. J., and it also owns the Pratt & Whitney Company, at Hartford, Conn., thus constituting this company very much the largest builder of iron-working machinery in the world.

The recent formation of the firm of Dilworth, Gilbert & Towne, is of interest among the iron and steel industries. The officers of the company are Chas. R. Dilworth, president; Thos. Town, vice-president, and Joseph M. Gilbert, secretary and treasurer. The company will represent several mills and also do a general jobbing and warehouse business in iron and steel. The active charge of the business will be vested in the secretary and treasurer, Mr. Gilbert, who has been connected with Denman & Davis, jobbers in steel and iron, New York, for the past five years.

The Westinghouse Companies report a number of orders for steam turbines and turbo-generators. This type of apparatus is frequently installed where it is necessary to increase the output of the station and where it is not possible to increase the floor space. Three of these outfits have recently been ordered by the Public Service Corporation of New Jersey, one having an output of 500 kilowatts and two with ratings of 1,000 kilowatts each. There are also a 1,000-kilowatt turbo-generator building for the Indian Orchard Company and a 400 horse-power induction motor with starting device, and two 300-kilowatt transformers. Westinghouse, Church Kerr & Co. are the designers and engineers for this station.

The last official act of the Panama Canal Commission before resigning was to close a contract with the Ingersoll-Sergeant Drill Company, of New York, for fifty standard rock drills of that company's manufacture, complete with mountings and equipment. These machines are to be used in the removal of rock in the great Culebra cut thru the crest of the Isthmus. The Commission furthermore authorized the same company to remodel a large number of French-Ingersoll drills, built in France under the patents of the American manufacturers. These machines remain from the original equipment of the old French Company formerly operating on the canal. This act of the Commission is interesting as showing the intention of using American machines and American methods in this, one of the greatest undertakings in the history of rock excavation, while the fact that the old drills are still in a condition to justify their use shows the superior merit of machinery of American type and design.

The Diamond Chain Factory, located at Indianapolis, Ind., has been purchased from the Federal Manufacturing Company by the Diamond Chain & Manufacturing Company, headed by Lucius M. Wainwright, who for the past five years has been manager of the plant, and who is generally regarded as one of the bet informed men in the country on the subject of chain transmission of power. The new company is incorporated under the laws of Indiana, with a capital stock of $400,000 fully paid up, $300,000 of which is common and $100,000 five per cent. preferred stock. The officers are: President, L. M. Wainwright; vice-president, E. C. Dunmeyer; secretary and treasurer, A. D. Johnson. The severance from any former ownership is complete, the entire stock of the Diamond Chain & Manufacturing Company being owned by Mr. Wainwright and a few local capitalists, Mr. Wainwright owning a controlling interest. The Diamond Chain Factory began operations in 1890, and the rapid growth of the business has twice necessitated increased quarters. The full capacity of the plant in all of its various departments is five million feet per year. The number of operators employed varies from 250 to 300. The product covers a wide range in styles and pitches, varying from those weighing only a fraction of an ounce per foot to those weighing thirty pounds per foot, including chains for hoisting apparatus, conveyors, automobiles, bicycles, cable, balancing and many other special designs. The factory is a model one; system, cleanliness, accuracy and quality being the foundation for all its product. The plant is filled with automatic machinery operated by twenty-eight motors. Thousands of feet of chains are used throughout the mill in addition to over four miles of leather belting. An independent gas plant is operated for case-hardening and tempering, and the uniformity of the heat treatment is gained by a thorough system of pyrometry, scientifically operated, such as is used by the twist drill manufacturers.

Manufacturers.

The Northwestern Railway will erect shops in Green Bay, Wis.

Hill & Bosley, Winchendon, Mass., will erect a new foundry.

F. W. Reece, Paris, Ill., is constructing an addition to his foundry.

The Seattle (Wash.) Wood Pipe Company will erect new buildings.

The Dayton (O.) Breweries Company will erect a large bottling plant.

The Clinton (Iowa) Novelty Works will erect an addition to its plant.

The Biddle Press, Philadelphia, Pa., is having a factory building erected.

The flour mill of Alex Dobson, Beaverton, Ont., was burned; loss, $40,000.

The Hess & Hopkins Leather Company will build a large addition to its plant.

The Morristown Woolen Company, Dexter, Me., will build an addition to its mill.

The plant of the Savannah (Ga.) Milling Company was burned; loss, $10,000.

Peter Christ & Co., Allentown, Pa., will rebuild their carriage and wagon factory.

The Lehigh Valley Railroad Company will erect a machine shop at Oak Island, N. J.

The Blake Asphalt Maintenance Company, Cincinnati, O., is putting up a new plant.

It is reported that the Tonhill Iron Works, of Pittston, Pa., will locate in Scranton, Pa.

The Cornell Incubator Manufacturing Company, Ithaca, N. Y., will build a new factory.

The Bigelow Carpet Company, Lowell, Mass., it is reported, intends to put up a new mill.

The Naugatuck (Conn.) Chemical Company is contemplating the erection of a new factory.

The Cleveland (Ohio) Wire Spring Company is having an addition to its factory built.

The Hartley Silk Manufacturing Company, Topton, Pa., will increase the capacity of its plant.

The General Electric Company, of Schnectady, N. Y., will enlarge its Lynn, Mass., plant.

Loeffelholz & Co., Milwaukee Wis., are planning to build a new foundry at their plant.

The Queen City Manufacturing Company, Seattle, Wash., planing mill will erect a new building.

The Orange (Texas) Lumber Company's mill has been burned; loss, $75,000. It will be rebuilt.

The Prattlow-Preserving Company has been incorporated at San Jose, Cal., with a capital of $120,000.

The Wheeling (W. Va.) Steel & Iron Company will make additions and improvements to its plant.

The Portland (Ore.) Gas Company will spend $50,000 on addition and improvements to its plant.

The Lake Erie Cement Construction Company, Norwalk, Ohio, will erect a factory at Huron, Ohio.

It is reported that the Colorado Eastern Railway, Denver, Colo., will erect new shops near the city.

The Parkersburg (W. Va.) Pickling & Preserving Company will shortly start work on its new plant.

The National Voting Machine Company is now located at 27 North Capital avenue, Indianapolis, Ind.

The plant of the Buffalo (N. Y.) Tin Can Company was damaged by fire to an extent of about $40,000.

The Great American Automatic Vending Machine Company, of Hoboken, N. J., is erecting a factory.

The plant of the Union Foundry Machine Company, Rochester, N. Y., has been burned; loss, about $20,000.

M. Caim & Bro., manufacturing chemists, of New York, will erect a $50,000 plant in West Bergen, N. J.

It is reported that the Riverside Mills, Augusta, Ga., will equip and operate a cotton mattress factory.

The West Allis Malleable Iron & Chain Belt Works, Milwaukee, Wis., will build an addition to its plant.

The McDanell Furniture Manufacturing Company has been organized at Warsaw, Ky., and will erect a plant.

The Randolph-Clowes Company, Waterbury, Conn., manufacturing brass tubes, is erecting a casting shop.

The Enterprise Box & Lumber Company, Milwaukee, Wis., is having a factory erected, which will cost $60,000.

The American Woolen Company is to build an addition to its mill at Woonsocket, R. I., and install new machinery.

C. H. Ely, of Sandusky, Ohio, will build a $50,000 plant for the manufacture of window glass at Independence, Kan.

The Fall Alpaca Company, Holyoke, Mass., will erect a power-house for furnishing and distributing its own electricity.

The Sturtevant-Larrabee Company, Binghamton, N. Y., will build a large addition to its carriage and sleigh factory.

The city of New York has purchased land in Long Island City, on which will be erected a municipal electric light plant.

The tannery and collar factory of Brandon & Delaperriere, Hoschton, Ga., has been destroyed by fire; loss, $125,000.

Fire in the foundry building of the Youngstown (O.) Foundry & Machine Company caused a damage of about $20,000.

The Passumpsic (Vt.) Fibre Leather Company, whose plant was destroyed by fire a short time ago, is starting to rebuild.

The Frictionless Metal Company will remove from Richmond, Va., to Chattanooga, Tenn., where a factory is being erected.

The Missouri Pacific & Iron Mountain Railroad will make extensive additions to its shops at Baring Cross, Little Rock, Ark.

The White Sewing Machine Company, Cleveland, Ohio, will erect a large plant to replace six factories now operated by the company.

The S. A. Woods Machine Company, Boston, Mass., has bought some land in South Boston, on which it will erect a new plant.

New Catalogs.

Purdue University, Lafayette, Ind. Annual catalog with announcements for 1905-1906. 5x7, pp. 236, paper.

Dayton Machine & Tool Works, Dayton, O. January, 1905, catalog of universal cutter and tool grinder. Half-tone illustrations. 6x9, pp. 14, paper.

Geo. F. Blake Manufacturing Company, 114 Liberty street, New York. Bulletin B-81, describing automatic feed pump and receiver. Illustrated, 6x9, paper.

Landis Machine Company, Waynesboro, Pa. Catalog describing Landis bolt cutters and nut-tapping machinery. Line and half-tone engravings. 6x9, pp. 11, paper.

Dodge & Day, Philadelphia, Pa. Bulletin 175, entitled "A Modern Industrial Plant," and which contains illustrations and description of a plant installed by this company. 6x9, pp. 15, paper.

Lucas Machine Tool Company, Cleveland, O. Pamphlet entitled "Common Sense and Mathematics," giving a few points about "precision" boring, drilling and milling machines. 3x6, pp. 12, paper.

Rockwell Engineering Company, 26 Cortlandt street, New York. Catalog "E," describing the Rockwell double-chamber melting furnace. This contains a statement of a day's operation of one of these furnaces, also cost of operating and maintaining compared with crucible furnaces. Half-tone illustrations and line drawings, showing construction. 6x9, pp. 20, paper.

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Punches & dies. Wal.M.Wks.,Waltham,Mass.

Wanted—Giant keyseater, No. 3. Address "Gears," care AMERICAN MACHINIST.

Will buy or pay royalty for good patented machine or tool. Box 282, AMER. MACHINIST.

Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N. J.

Wanted—A second-hand, foot power screw cutting lathe. F. Russell, 23 Grant st., Utica, N. Y.

Wood patterns of every description; high-grade gas engine work a specialty. Trenton Pattern Works, Trenton, N. J.

Automatic and intricate machines designed, ideas developed, by an expert. Can I help you? Box 496, AMERICAN MACHINIST.

Dies, jigs and fixtures; tools designed for special work; manufacturer of clockwork specialties and intricate mechanical instruments. D. S. Plumb, 57 E. Park st., Newark, N. J.

Medium size modern plant wants contracts; close work on automatic and interchangeable machinery; will buy good tool or machine, or manufacture on royalty. Box 521, AM. M.

Wanted—Manufacturers to use premium system; shop cost reduced; output increased; no trouble with employees; system successfully installed; results guaranteed. Box 525, AMERICAN MACHINIST.

Agent wanted in every machine shop for new Wiet-Goethe caliper gauge; $20 worth of tools for $2; double your daily wages while selling them and still work at your trade; big profits. Address for particulars, Wiet-Goethe Company, Sacramento, Cal.

Automobiles.—Their operation, care, management and construction, together with scale drawings showing how an up-to-date machine can be built for $500, sent on receipt of request enclosing 2-cent stamp. McLaren Automobile School, 54 No. 13th st., Philadelphia.

A Continental firm of machine tool importers, having large showroom in Paris, excellent connection and staff of travelers, require sole agency for first-class make of upright drilling machines up to 42 in. size, for France, Belgium and Switzerland. Reply Box 462, AMERICAN MACHINIST.

Modern foundry and machine shop, fully equipped for light and medium heavy work, wishes to manufacture engines, machines or machine parts; would undertake sale if desired; castings made in malleable, gray, brass, bronze and aluminum. Trenton Malleable Iron Co., Trenton, N. J., and 26 Cortlandt st., New York.

For Sale.

For Sale—Machine shop in southern Michigan; good, live, paying business. Address Box 494, AMERICAN MACHINIST.

I can sell your machine shop (or other business), with or without real estate, no matter where it is or what it is worth. Send description, state price and learn how. W. M. Ostrander, 111 North American Bldg., Philadelphia.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be enclosed to unknown correspondents. Only bona-fide situation want or help want advertisements inserted under this heading. Agency advertisements must be placed under Miscellaneous Wants.

Situations Wanted.

Classification indicates present address of advertiser, nothing else.

CONNECTICUT.

Foreman position, by expert machinist, tool and die maker; all-round man for machine shop, sheet metal, rubber goods, insulated wire or any other factory. Box 519, AM. M.

A thorough, all-round mechanic; 21 years' experience on tools, gauges, fixtures, special and automatic machines for duplicating parts, model and experimental work, typewriters, electrical typewriters, sewing and letter canceling machines, etc., etc.; 8 years' experience in managing help, having charge of different departments, such as manufacturing, assembling and also toolrooms. Box 532, AMERICAN MACHINIST.

INDIANA.

Cost accountant; 4 years experience in large machinery plant; can give reference. Box 526, AMERICAN MACHINIST.

ILLINOIS.

Member A. S. M. E., 10 years as chief draftsman and leading designer of hoisting machinery; steam, electric, hydraulic and hand cranes; traveling, gantry, R. R. wrecking, jib, pillar, etc., 1 to 150 tons; also proposals, specifications and shop methods of building cranes; seeks wider field than present employers can offer. Box 500, AM. M.

MASSACHUSETTS.

Gray iron foundry superintendent wishes to change; engines, machinery; practical in all departments; up to date; good references. Address Box 542, AMERICAN MACHINIST.

Wanted—Position in charge or operating a battery of automatic screw machines, familiar with all makes; A1 toolmaker; 15 years' experience, with best of references. Address D. M., 56 Chandler and Clareton st., Boston, Mass.

Position wanted as assistant superintendent or in like capacity; 14 years in machine shop and drafting room; familiar with the best present-day shop practise in the working of men and machines, and experienced in the manufacture of accurate interchangeable work; age 34. Address Box 546, AM. MACH.

NEW JERSEY.

Draftsman, designer, technical graduate and experienced, seeks position. Address Box 528, AMERICAN MACHINIST.

Position as hardener of steel; experienced on high-grade steel and high-speed steel; can furnish best of reference. Box 527, AM. M.

Wanted—Position as general foreman who understands systematic cost reduction and high-speed steels, and get out the work; best of reference. Box 535, AMERICAN MACHINIST.

Situation wanted by a first-class mechanical draftsman and designer; 20 years' experience in heavy sawmill work, air compressors and Corliss engines; A1 reference. Address Box 530, AMERICAN MACHINIST.

NEW YORK.

Up-to-date tool and die maker; two years as foreman, open for engagement, New York preferred. Box 539, AMER. MACH.

Mechanical draftsman, near, accurate worker, having 7 years' experience, desires position. Box 533, AMERICAN MACHINIST.

First-class mechanical draftsman, designer on automatic machinery, fixtures and tools, wants change. Box 548, AMER. MACH.

Mechanical superintendent desires position; competent to systematize factory and reduce costs. Box 543, AMERICAN MACHINIST.

Mechanical draftsman, with 6 years' experience, desires position; shop or office; 4 years' practical shop experience. Box 534, AM. M.

Mechanical engineer with experience on gas and steam engines desires position as engineer assistant. Box 547, AMER. MACH.

Position of capacity wanted by man whose specialty is engine and boiler building, cost accounting, rate fixing, etc. Address Box 520, AMERICAN MACHINIST.

Engineer and designer, 9 years' experience, wishes position in charge of engineering department; cranes, coal and ore handling machinery, structural work. Box 531, AMERICAN MACHINIST.

Electrical engineer, class 1902, age 27, 3 years' practical experience in power plant and factory work, desires position as consulting engineer in factory. Give detailed answer, nature of work and salary offered. Box 541, AMERICAN MACHINIST.

Mechanical and civil engineer, 29, graduate of German university, with good experience in cranes, conveyors, general machinery, structural work and installation of manufacturing plants, etc., open for engagement. Box 549, AMERICAN MACHINIST.

Mechanical engineer, 12 years' experience, desires change; up to date on tools and fixtures, cost reduction and shop management; successful in the design and construction of hoisting and conveying machinery; experienced estimator and correspondent. Box 486, AMERICAN MACHINIST.

PENNSYLVANIA.

Mechanical draftsman wants position; technicap graduate; 3 years' shop experience, 4 years in the drafting room. Box 538, A. M.

Draftsman, 9 years at steam engines, pumps and hydraulic machinery, wishes situation; good designer; any location. Box 540, A. M.

Technical graduate, 8 years experience in engine work and general and commercial engineering, desires to change responsible position. Box 471, AMERICAN MACHINIST.

Mechanical engineer (Swede), of 7 years' experience designing steam engines, petroleum engines, pneumatic tools, jigs and tool machinery, desires position. Box 522, AM. M.

Machinist, German, 28, desires position as foreman; has 13 years' experience in presses, dies, special machines and gas engines; is good designer; small and medium work preferred. Box 537, AMERICAN MACHINIST.

Mechanical draftsman, age 33; experienced on punch and shearing machinery, structural work, shop layouts, dies for car forgings and pressed-steel shapes; familiar with machine shop practice, and have had charge of drawing-room. Address "K.," care AMER. MACH.

VERMONT.

Position wanted by draftsman of 12 years' experience on valves, hydrants, and general water works and hydraulic machinery; fine designer; references. "Hiller," care A. M.

Help Wanted.

Classification indicates present address of advertiser, nothing else.

CANADA.

Wanted—A mechanical superintendent for one of the largest and best equipped machine tool, press and general machinery plants in Canada; one who will take a reasonable financial interest in the business; must have thorough knowledge of costs, handling men, master details, produce results and be capable of producing accurate interchangeable work advantageously; state age, experience, last positions filled, references and salary wanted. Box 511, AMERICAN MACHINIST.

CONNECTICUT.

Wanted—Six first-class patternmakers on heavy machinery work; good wages; no trouble. Address Farrel Foundry & Machine Co., Ansonia, Conn.

Wanted—Model maker in a large, steady-running, old-established factory, 100 miles from New York city; state age, experience and wages wanted, habits, etc. Box 481, AMERICAN MACHINIST.

DISTRICT OF COLUMBIA.

Draftsmen Wanted.—An examination for marine engine and boiler draftsmen and assistant marine engine and boiler draftsmen, to provide an eligible list from which appointments will be made in the Naval Service at any time within three years there-

A Decimal Time System for Factories.

BY H. B. MC CABE.

I note with interest the description of the decimal time clock devised by Wilfred Lewis, at page 1729, Vol. 27, and the suggestions relating thereto by Henry Hess at page 229.

Having devoted some thought to economical factory management, I am led to describe a few devices which have suggested themselves to me since reading these articles. The simplicity of cost figuring in the decimal system appeals very strongly to me. I think the scheme suggested by Mr. Hess is not as complete as it should be. It is quite true a clock that would rest during the non-working hours would be quite costly, yet not unduly so, if the decimal scheme is worth using at all.

In connection with the devices about to be described, I would use a record system designed to provide an incentive for the workman to promptness and accuracy in making his time reports, and to minimize as much as possible the labor and mental effort used in doing it. I have found workmen, as a rule, prone to neglect this important duty, and very naturally, too, for it necessitates a deviation of the mind from the course of thought bearing on the work in hand, and the strong inclination is to let it go until near the end of the day's work and then try to remember the different jobs worked on since morning and make rough estimates of the time on each. All labor expended in keeping time

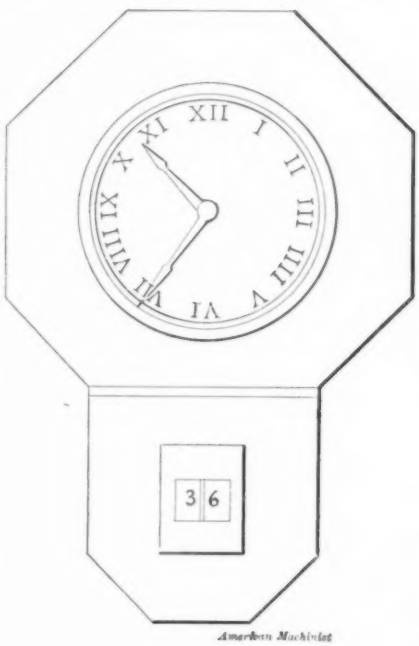


FIG. 1. COMBINATION CLOCK.

and cost records, both by workmen and by clerks, is non-productive. If the devices and methods here described would eliminate part of this, it would certainly pay their first cost in a short time.

In this system I would not dispense with our time-honored, twelve-hour dial nor change the gear train, and the clock would run continuously.

For use in a small factory, Fig. 1 shows an arrangement in which the lower part of the clock door is fitted with a counter of two wheels having large, plain figures and reading from 0 to 99. A cam of ten

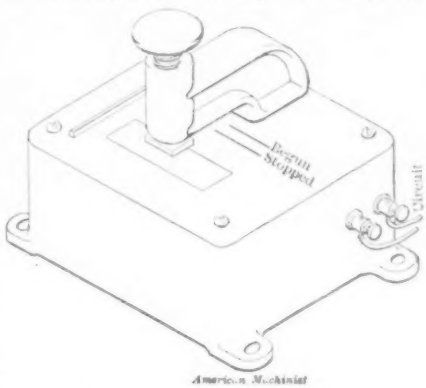


FIG. 2. THE TIME STAMP.

lobes is attached to the center spindle of the movement. This operates a lever which, thru suitable connecting links, causes the counter to register every six minutes, or one-tenth of an hour. On the hub of the hour wheel which carries the hour hand is attached a cam so shaped and connected that between the hours of 12 to 1 and 6 to 7 it will hold this lever away from the ten-lobed cam, thereby accomplishing the same result Mr. Lewis does by stopping the clock during these periods. The connecting mechanism may easily be made to part when the door of the clock is opened. The ordinary clock may be rigged up in this way with but little more work than making the new dial and gears and adding the pendulum starting and stopping device, and it would have the desirable advantage that the time of day could be read in the usual way, and it would automatically cut out the non-working hours.

Another arrangement suggests itself, which would be suitable for a large factory having various departments. This consists of a series of time stamps of the outward appearance of Fig. 2, one or more being placed in each department in places easily accessible to all workmen. Each of these contains a counter similar to that mentioned above, except the figures on the wheels are steel type, and they are electrically actuated by magnets, in circuit with a make-and-break device in the controlling clock. A typewriter ribbon is interposed between these type wheels and the plunger above. The circuit is automatically broken in the clock during the non-working hours.

In use, if starting on a new job, the job card is placed against the guide at the left with its farther edge at the line marked "begun" and is stamped. When thru with the job it is again stamped with the same edge at the line marked "stopped." The card will then show the figures for the time of starting and of stopping decimally and in position to be subtracted.

Fig. 3 suggests a form of job card to be used. Each workman is to be provided with a supply of these. When starting in the morning he stamps a card. If during the day he finishes the job or drops it unfinished to take up another, he writes the job number on the card, stamps it and places it in a pigeonhole case provided and immediately stamps another to be used on the succeeding job. It being the object to relieve the workman as much as possible, the cards may be supplied to him with his name or number previously stamped thereon and the dates may be stamped on by the clerk after collecting them.

The figures representing the time and cost, each being stated in decimals, suggest the use of the slide rule for calculating the cost in dollars and cents, from the time, in hours and tenths of hours. As there are generally a limited number of different rates per hour used in the pay-roll, a set of scales may be laid out on a sheet of bristol board one for each rate. Fig. 4 shows one of these scales arranged for 12½ cents per hour. Supposing his card shows a man has worked 6.4 hours on a job. The cost is read instantly 80 cents. Again, suppose he has worked on another 2½ hours. The cost is 31 cents. This is done so quickly and with so little mental effort that only the figures of cost in dollars and cents each day need be put on record. In this way the record will show right up to date the exact cost of labor that has been expended on any job in progress. I am inclined to think that after all this may be the most valuable feature of the system.

It may at first appear that this system is applicable only where the ten-hour day is

DAY WORK

WORKMAN	216	DATE	2-8'05
Stopped	82	ORDER NO.	321
Begun	36	PART NO.	K 64
Time	46	COST	.58

American Machinist

FIG. 3. THE TIME CARD.

used, but this is not true, provided the pay is by the hour, as a little reflection will show. A clock and set of stamps designed for the ten-hour day will answer as well for the nine- or eight-hour day.

Fig. 5 is a view of the stamp with the shell broken away, exposing the type wheels and the actuating mechanism. The U-shaped frame *a* swings freely on the shaft of these wheels and carries two pawls, one to engage the ratchet of each wheel and both being made in one piece, so that they act together. They are placed at such an angle to each other that the one at the left can engage its ratchet only

when the one at the right falls in the deep notch *b*. Thus the tens wheel is moved one notch for each turn of the units wheel. As far as I know, this way of moving counting wheels is new. The balance of the sketch I think explains itself.

Fig. 6 is a detail of the controlling mechanism in the clock, *c* being a portion of the frame of the movement, *d* the center shaft which carries the minute hand, *e* the hour wheel which carries the hour hand, and *g* the reducing gear wheel with its pinion. A ten-lobed cam *m*, very much

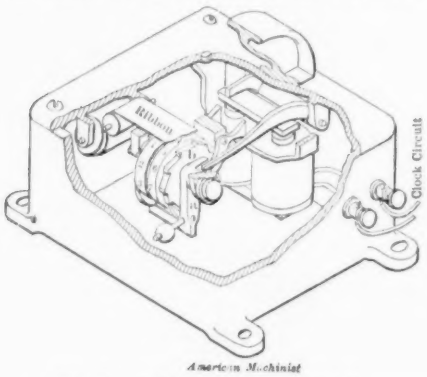


FIG. 5. MECHANISM OF STAMP.

like a ratchet wheel, is made fast to the center spindle *d* back of the reducing gear. This actuates the levers *h* and *i*, causing them to close the circuit every 6 minutes, or 1-10 hour. Passing thru the lever *h* and insulated from it is the small platinum pin shown; this makes contact with lever *i* and on it presses the flat spring *k*. The current passes from the upper terminal *l* thru this spring and plug to the lever *i*, thence thru the frame of the movement and the contact *n* to the terminal *f*.

In the position shown the lever *h* has just dropped, making the contact with *i*. In a few seconds later, when the cam *m* will have turned a trifle farther to the right, the lever *i* will drop. The lever *h* cannot follow on account of the stop-pin and the circuit will be broken. This gives the magnets in the stamps time to perform their work.

To the hub of the hour wheel *e* is attached the cam *t* which actuates the lever *r* in such a way that the contacts *n* are parted during the non-working hours of the day.

By mounting this system of levers on a brass plate to be attached to the frame of the movement under the reducing gear train, this device can, I think, without great difficulty be applied to a standard clock movement.

A cubic foot of earth weighs about five and a half times as much as a cubic foot of water. A cubic mile of earth then weighs 25,649,300,000 tons. The volume of the earth is 259,880,000,000 cubic miles. The weight of the world without its atmosphere is 6,666,250,000,000,000,000,000 tons. If we add to this the weight of the atmosphere given above we get a grand total—6,666,255,819,600,000,000,000 tons. No wonder Atlas became round-shouldered!

Legal Notes.

BY E. P. BUFFET.

UNGUARDED MACHINERY NOT PROXIMATE CAUSE OF ACCIDENT.

A workman in a foundry was injured by catching his hand in gears of a crane, as a result of stepping on a loose piece of shafting on the floor, which caused him to slip. The gears, it appears, were not guarded, as generally required by statute (altho it is undecided whether the statute applied to this case). It seems that the company was not legally responsible for the presence of the piece of shafting on the floor, or for his slipping, which was not a proximate, natural and probable consequence of leaving the gears unguarded. The company is held by the court not liable for his injury even if it were at fault as to the condition of the gears. The Supreme Court of Indiana (which reverses the lower court) says: "The unguarded condition of the wheels did not in any way bring about appellee's fall. He would not have been injured if he had not stumbled and fell. Assuming that it was negligence in appellant to leave the cog-wheels uncovered, if appellee had purposely thrust his hand into them it is clear that he could not recover. If he thrust it in, in consequence of a cause set in motion by himself, and for which appellant was not to blame, the principle is the same so far as affects his right of recovery." (P. H. & F. M. Roots Co. vs. Meeker, 73 N. E. Rep. 253.)

The decision in this case may be a little surprising, in view of the fact that it does not rest on proof of negligence in the injured man. Cases under the Indiana laws relative to guarding machinery have previously been commented on in these notes, and while the rule in that State seems to be that contributory negligence may prevent recovery, even where the employer has violated the statute, his liability is somewhat more severely viewed than in cases resting on Common Law grounds, which is shown by the holding that the doctrine of "assumed risk" cannot be invoked to bar a recovery by the injured party as in Common Law cases. (Vol. 27, page 1599.)

RIGHT-HANDED AND LEFT-HANDED WORKMEN.

Thomas Hilton, a blacksmith employed by the Fitchburg Railroad in Keene, N. H., sought to recover from the company for injury to his eye. Evidence was offered tending to show the following: His work was tempering and setting up springs for locomotives. This was customarily done by two blacksmiths and two helpers working together, and a part of it required striking by one of the helpers upon the head of a "set" held by Hilton. The arrangement of the work was such that some of the blows should be dealt sideways and left-handed; these were usually given by left-handed strikers, since few men are ambidextrous. One day the ordinary left-handed striker was absent and the foreman supplied a right-handed man whose second left-handed blow struck on one side, causing to fly the chip that did the mischief. Recovery was sought on the ground that

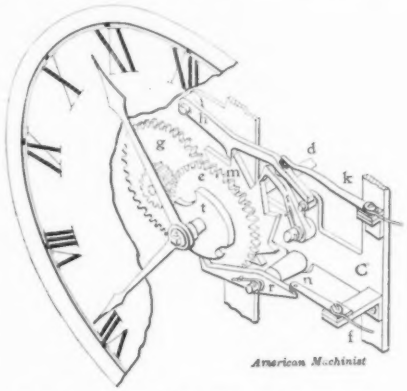


FIG. 6. MAKE AND BREAK IN CLOCK.

the foreman, acting as representative of the employer, failed to furnish a suitable instrumentality for the work when he supplied the right-handed helper. Upon the view of the total evidence most favorable to Hilton, the Supreme Court of New Hampshire holds that he cannot recover. This is based on substantially the following theory: The employing company presumably had complied with its general obligation in furnishing enough left-handed men as animate tools of the work. The selection of these for certain jobs in individual instances was a matter of detail in their use which the company could not be expected in all cases to arrange, but which must be left to the workmen themselves. The foreman in making such a choice was acting in the capacity of a co-employee, not of a vice-principal, and his negligence (tho it does not seem to be shown that there was any) should not therefore be imputed to the company.

59 Atl. Rep., 625.

FIG. 4. LOGARITHMIC SCALE FOR COMPUTING COSTS.

The Automatic Versus the Hand Turret Lathe.

BY P. V. VERNON.

Writing on this subject at page 108, Paul Wesley commences by hoping that no one will think he is prejudiced against the automatic. He goes on to show that

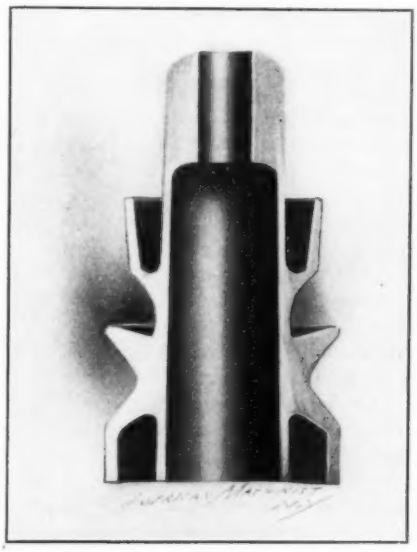


FIG. 1. THE WORK SPLIT, SHOWING THE DIFFERENT CUTS REQUIRED.

if not prejudiced against it he is by no means predisposed in its favor.

Mr. Wesley's remarks as to the pompous appearance of the traveling salesman for Blank & Blank, as to the machines being pretty, with nice slender parts, as to the tools "fearfully and wonderfully made" and as to the maker's operator being glad when his week was up, show his mental attitude as being not such as to conduce to impartial investigation of the points of the machines and to patient endeavor to master them and to make them a success.

The tone of the article is, in fact, exactly that which all makers of improved machinery are accustomed to expect from men of the old school who oppose modern methods, either because they do not understand them or because they lack the energy required to give up old methods and to make new ones a success.

I beg leave to quote the following from the last paragraph but one of Mr. Wesley's article:

"It seems very funny to me that the builders of these automatics always think that they know more about what tools are needed for the machines than the people who have done the work for years."

Why this fact should be considered "funny" I do not know, but I think that all who have had experience with the installation of automatic machinery in workshops which have previously used hand methods only, will agree that it is true that the builders of automatics do generally know more about the tools required for them than those who have done the work by the old-fashioned system only, and I think it would be, if not funny, at all events astonishing to expect manufacturers, no matter how expert with the old methods, to be capable of fully understanding the possibilities of automatics and the kind of tools which can be used upon them at first sight and without previous experience of automatic machinery.

MAGAZINE AUTOMATIC WORK.

The work dealt with in Mr. Wesley's article is the manufacture of whirls or wharves, of which many hundreds of thousands are made weekly in Europe. I have been associated with the design and equipment of automatic machines for doing this exact work at the works of Alfred Herbert, Ltd., of Coventry, England, and am able to state that not only are automatics a success on such work, but that they are being largely used by the leading makers both in England and on the Continent. Inquiries have been made of a number of users of automatic machines for this work, and in every instance the machines are reported as giving satisfaction, the work being fully up to standard as regards accuracy and running truth, and the costs satisfactory.

So much for general statements. I will now deal with the method by which the work is successfully done in this country and which differs somewhat from that described by Mr. Wesley. It should be understood, however, that whirls are made in several patterns, of which the example forming the subject of his article is about the simplest and most easily dealt with and can be produced at the rate of about 135 per day of 10 hours on two machines. Some of the other forms of whirls are very much more involved in outline, and the economy on automatics is therefore proportionately much higher.

The photograph Fig. 1 representing the piece split to show the amount of tooling required, and the appended drawings will give a good idea of the tool outfit used for making a much more difficult pattern of whirl, and the photograph Fig. 2 shows the type of machine upon which the work was done. The actual sample shown by this photograph is not a whirl but a spinning spindle bolster, large numbers of which are made on automatics; the type of machine and the magazine are, however, exactly the same as used for whirls.

Two machines are used to make the complete whirl and the work is completed at two operations instead of three, as in the case of the previous method described by Mr. Wesley. Both machines are fitted with magazines, the second operation machine having a fan for blowing air thru the spindle so as to keep the chuck free from dust. Only a gentle blast is required, as the object of the air current is not so much to blow the dust out as to prevent it from getting into the chuck.

The whirls are made from soft iron castings, considerable attention being paid to the quality of the metal. The castings are well rattled to get rid of sand. There is no advantage in having hard castings, and I recommend Mr. Wesley to look into this matter on his own work. He will probably find some of his trouble to be due to the material he is using.

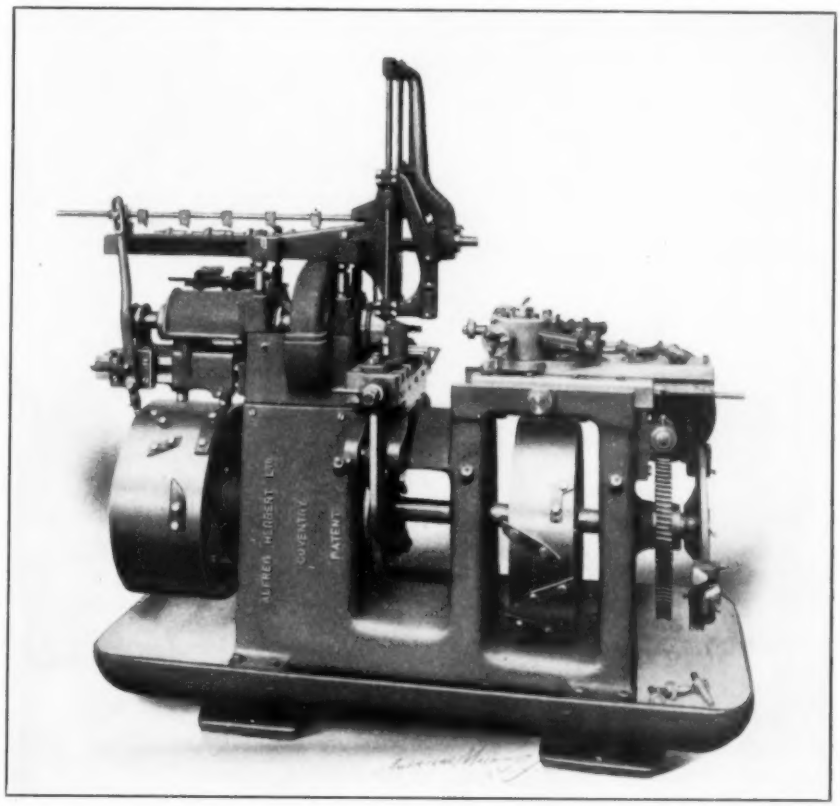


FIG. 2. MAGAZINE AUTOMATIC FOR GRAY-IRON WHIRLS.

The magazines are of the standard overhead type of Alfred Herbert, Ltd., and have been previously described in the AMERICAN MACHINIST. The trough of the magazine is filled with castings which are supported in malleable shoes *A*, Fig. 3. The shoes hold the castings in the proper position until they are chucked, and then fall into the chip tray, being collected from time to time and used over again. The use of shoes of this kind enables the same magazine to be used for a number of different designs of whirls or even for different work altogether.

The whirls are fed automatically into the three-jaw chuck which has a spring adjustment to accommodate variations in diameter. The chuck grips them automatically, the castings being held by the large end and afterward the operations proceed as follows:

FIRST OPERATION MACHINE.

Center and face with the centering and facing tool *B* in the turret, and at the same time rough form the intermediate diameter with the form tool *C* at the front of the cross-slide.

Drill and rough turn the taper portion with special tool *D* held in the turret.

Finish turn the taper and round the end with special tools *E* and *F* held in the turret.

Eject from the chuck with the ejector rod carried by the spindle and actuated by a cam at the rear of the machine.

Tools *D*, *E* and *F* are form relieved to allow for a considerable amount of grinding without material alteration of form. Liner *G* of gray iron fits the carrier which lowers the work from the magazine, and supports the piece while it is slid into the chuck by pusher *H* in the carrier and a spring pusher in the turret.

The time for the first operation is 2 minutes 30 seconds each, corresponding to an output of 240 per day of ten hours less whatever allowance may be required for tool setting.

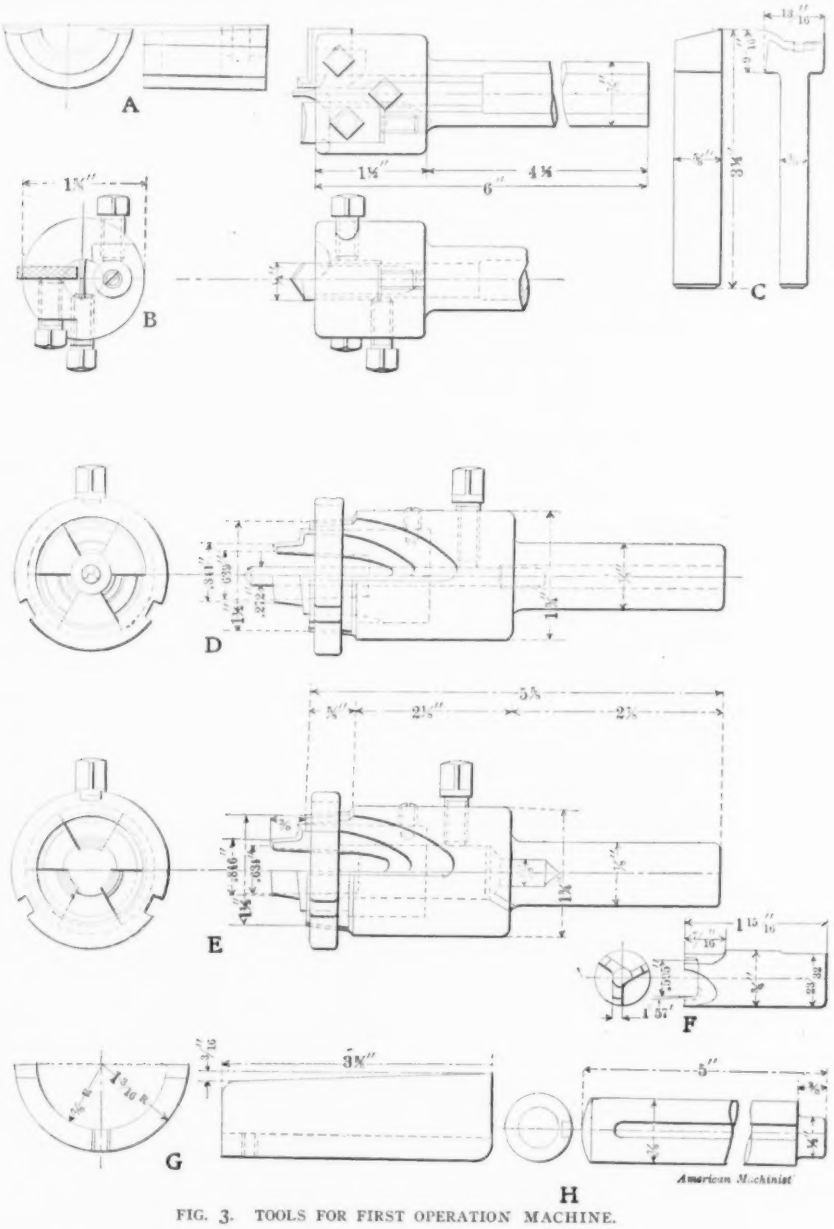


FIG. 3. TOOLS FOR FIRST OPERATION MACHINE.

SECOND OPERATION MACHINE.

For this operation a spring collet chuck *I*, Fig. 4, is used instead of the three-jaw chuck employed for the first operation. The collet is ground perfectly true after splitting and tempering, and holds the work by the taper portion finished on the first machine, the air current from the fan keeping it clean and free from dust. The following are the operations:

Center and face with centering and facing tool similar to *B* (Fig. 3).

Form the pulley and finish form the intermediate portion with form tool *J* on the front of the cross-slide.

Rough drill the large hole with drill and at the same time rough out the annular recess with a form relieved cutter held in holder *K* in the turret.

Finish drill the large hole and finish form the annular recess with form relieved cutter *L* held in the turret.

Ream large and small holes with reamer *M*, held in a holder in the turret.

This reamer is in two parts so that either part can be ground or renewed independently.

While this latter operation is going on the undercut at the back of the pulley is produced by the swinging tool *N*. This tool is carried at the back of the cross-slide of the machine and is actuated by the adjustable screw on the reamer holder *M*. A spring returns the tool when the reamer is withdrawn.

The time for the second operation is 4 minutes 5 seconds, corresponding to an output of 146 per day of ten hours less whatever allowance is required for tool setting. A complete plant for this work contains, of course, more second than first operation machines in order to balance the product. In the figures given above as to output, it should be remembered that the work was done with carbon steels and that there are great possibilities of increased output by the use of high-speed steels.

The ejector rod inside the spindle of the machine is shown at *O*. At *P* is the pusher held in the carrier which lowers the work from the magazine to the chuck; and at *Q* the liner fitted in the carrier and shaped so as to support the work properly while being chucked. *R* is a dead stop attached to the cross-slide of the machine so as to limit its movement accurately when forming; the stop is adjusted so that the lever is slightly sprung when on the point of the cam, thus keeping up a constant pressure on the forming tool so as to reproduce the same diameter even when the tool has become slightly dull. *S* represents the spring pusher in the turret which pushes the work out of the carrier into the chuck thru the medium of the pusher *P*. The spring insures that the work shall be held firmly up in the jaws until they have gripped.

COST OF TOOLS AND REPAIRS.

Regarding the question of cost of tools and repairs on automatics, it is generally found somewhat difficult to obtain reliable

figures from users, who, if they keep such costs accurately, do not care to supply them for purposes of publication, or, in cases where they are supplied, no details are given as to how they are arrived at, figures being of doubtful value for purposes of comparison. A great deal depends on having a good supply of replace

and quantity of work done on each piece, and he instances a case in which 70,000 pieces were made on automatics at a total cost for tools and repairs of £2—surely a moderate figure. For making tools for whirls, the first cost is of course higher than this, but the upkeep is quite small in proportion to the output.

ated in a certain way did not compete successfully with his previous lathes. He does not, however, demonstrate that the same machines set up in a different way would not have been successful, or that other automatic machines could not have been successful, or that the automatic *qua* automatic is unsuitable for such work, and

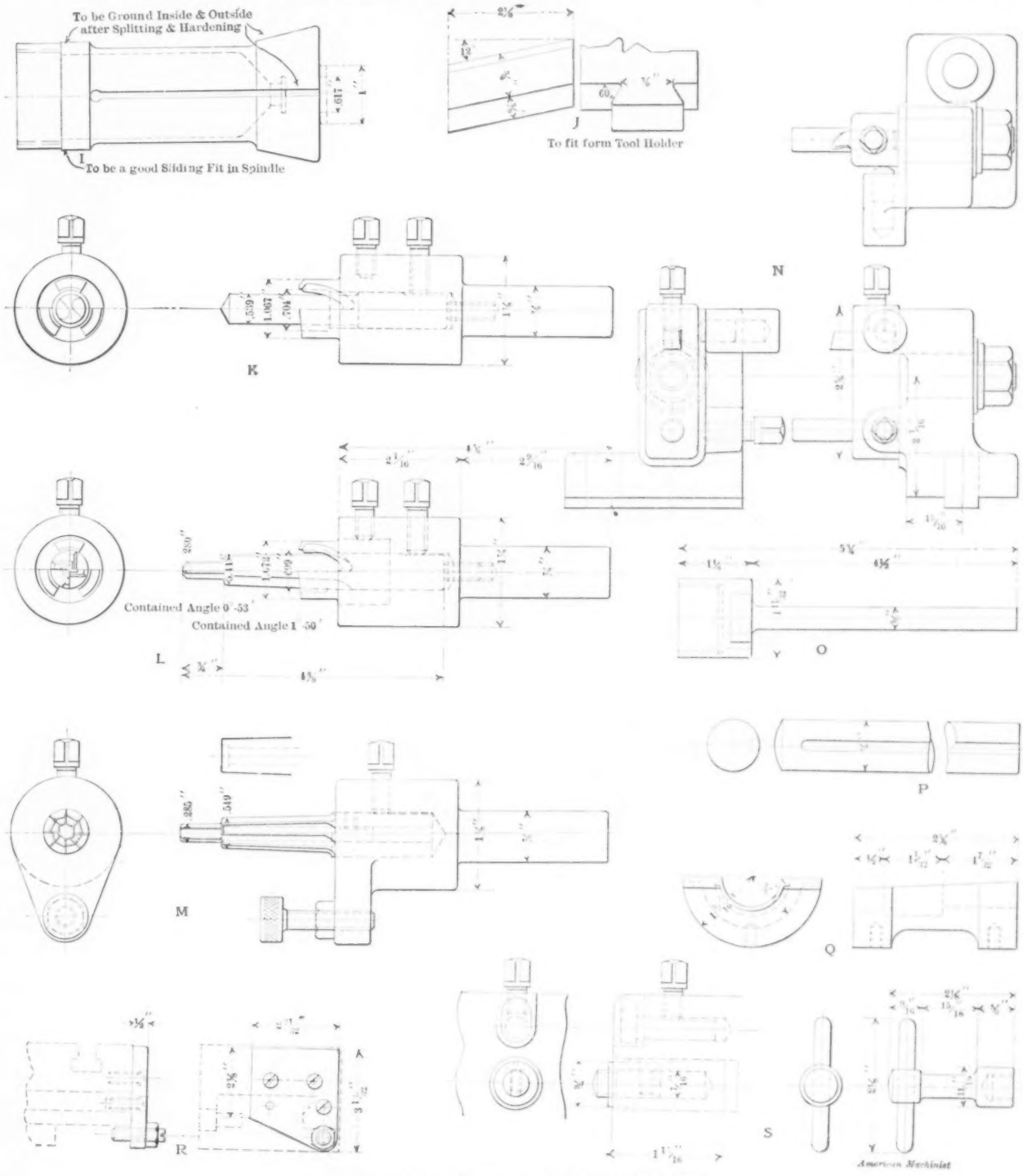

To be Ground Inside & Outside after Splitting & Hardening
To be a good Sliding Fit in Spindle
To fit form Tool Holder
Contained Angle 0° 53'
Contained Angle 1° 30'
American Machinist

FIG. 4. TOOLS FOR SECOND OPERATION MACHINE.

cutters on hand at all times, so as to keep the unproductive periods down to a minimum.

I have recently been favored by a large user of automatics doing work which, altho not exactly the same as the work in question, is similar with regard to the size

I am not sure that Mr. Wesley's article will do very much to benefit either his own industry or that of the makers of automatic machines and may result in some prejudice on the part of potential users. His article goes to prove that certain automatic machines set up and oper-

in fact the last paragraph in his letter shows that automatic machines set up in a rather different way have actually been a success on his own work.

It must be remembered that in many cases where automatic machinery is tried for the first time it has to compete with

old hand processes which depend for their success largely upon the dexterity of the workman, which is often reached only by years of training, whereas the automatic is started with practically unskilled labor and is expected to produce good results in competition with the older method as soon as the belts are on. To those who have had experience in the use of automatic machinery on such work, there will remain no doubt at all that when the workmen are used to the machines and have acquired some degree of skill in operation the cost of the work will go down and the quality will go up.

In dealing with matters such as the above, I think it is important to remember that the natural tendency of those who are already working under an organized system of manufacture is to oppose the introduction of any method which will interfere with their comfort and the smooth tenor of their days and the automatic in consequence generally comes in for a good many hard words and a good deal of more or less captious criticism.

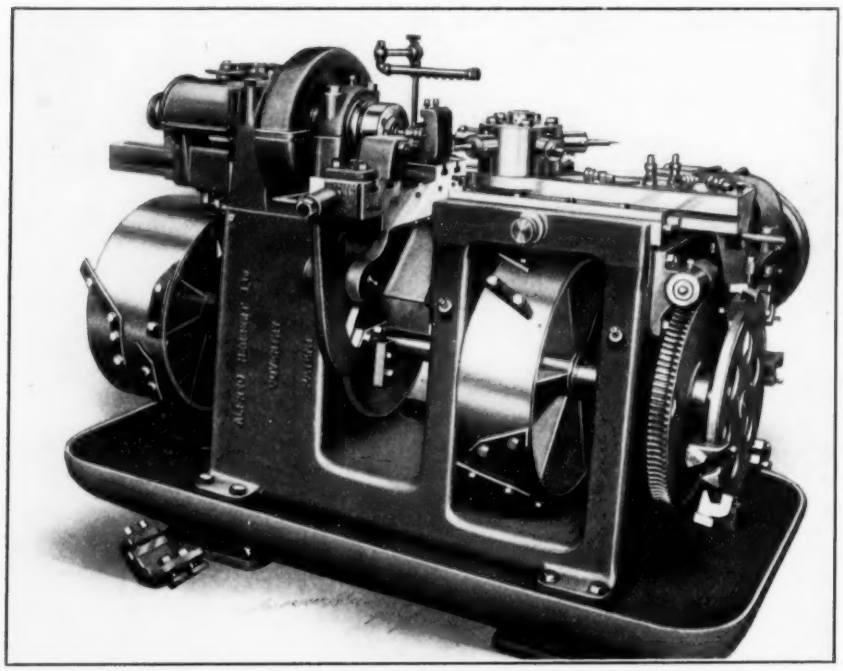


FIG. 5. AUTOMATIC EQUIPPED FOR MAKING WHIRLS FROM THE BAR.

Regarding whirls from steel bars, this has been tried but given up. The photograph Fig. 5 shows a machine equipped for this, but the method was afterward changed and turned gray-iron bars were used instead.

The Boston Elevated Railroad has laid down some manganese steel rails at points on its line exposed to extraordinary wear. These rails have to be cast, as they cannot be rolled, and they cost $5 per foot, as compared with Bessemer rails at 28 cents, but the difference in durability is considered to more than balance the greater cost. Manganese steel castings will probably flow, however, in such service.

The Layout and Construction of Cams—V.

BY CHARLES F. SMITH.

RAISED PATHWAY CAMS.

Figs. 27, 28, 29 and 30 show raised pathway cams with two rollers which are used when it is desirable to be able to take up wear—the rollers being mounted on a block which permits their adjustment toward one another. Figs. 27 and 28 show respectively the profiles for perifery and face cams for operating a roller mounted on a slide, and Figs. 29 and 30 for operating a roller mounted on a radius arm, the four forms being shown in order to illustrate the effect of this construction in distorting the curves whereby, unlike the two edges of the grooves heretofore shown, the two sides of the ridges are no longer parallel and in some of the forms they are very far from parallel.

The pitch lines of cams of this style are laid out as in the previous cases, the centers of the rolls being found by striking arcs *a a a*, *b b b*, which intersect the lines of movement of the slide or the arcs drawn from the division points of the radius arm center line.

Successful cutting of this style of cams for use with rollers mounted on a radius arm can only be done on a radius arm attachment similar in principle to that shown in Fig. 26, the length of the radius arm of the attachment being equal to that which is to carry the roller. Moreover, this attachment should have two cutter spindles so that both sides of the ridge may be cut at the same time. A single sided former with one roller bearing against it is all that is necessary in that respect, but the side chosen should be adhered to. For perifery cams it is immaterial which side is chosen, but for face cams the outer curve is preferable, as it is of larger diameter and has easier curves and thus produces more satisfactory work.

YOKE CAMS.

Fig. 31 shows an excellent form of cam which is sometimes available. As in all other cases, the first considerations are the throw and the angle of the cam's movement during which the movement of the rollers takes place. The movement may be either continuous or intermittent, the latter case being shown. Radial lines *A B*, *A B* are drawn to include the angle of movement which is then divided as in former cases to agree with the divisions of the throw circle and the curve of the opposite side is then so laid out that the distance between the diagonally opposite rollers is, in all cases, the same.

The yoke may obviously be placed on a radius arm, in which case the radius lines become arcs of circles struck from the circle thru the center of the fulcrum pin.

CONICAL CAMS.

There is a great variety of special forms of cams which are occasionally required, and of these Figs. 32 and 33 show the conical form which I found necessary to use recently in connection with a paper folding machine. In Fig. 32 the groove is external to the cam and the roller is mounted on a slide, while in Fig. 33 the groove is internal and the roller is carried by a radius arm. The angle of the cone is of course determined by the connections to the operating parts, while the diameter, as with other forms, is made such as to keep down the angle of the groove.

In laying out this form the length *a b*, Fig. 32, of the side of the cone is taken in the dividers and the arc *c d e* is drawn with it as a radius. The length of this arc is then made equal to the entire circumference of the base circle of the cone *b f* and the arc *c d e* is then to be treated as tho it were a complete circumference of 360 degrees and the angles *g h i* and *j h k* laid down to cover such parts of the arc *c d e* as the actual arcs of movement cover parts of the circle of the cam. The throw circle and the profile of the groove are then laid down as in previous cases and the templet is cut, the ends being defined by the radii *c h* and *e h*. The templet will then wrap around the former, the end lines meeting as they should.

The circle *l m* is equal in diameter to the pitch circle of the cam groove at its outer radius and points *n*, *o*, *p*, *q* of the templet fall on *r s t m*, respectively, of the former, the arcs *n o*, *o p* and *p q* being equal respectively in length to *r s*, *s t* and *t m* of the former.

The procedure of Fig. 33 will be understood without lengthy explanation after what has gone before.

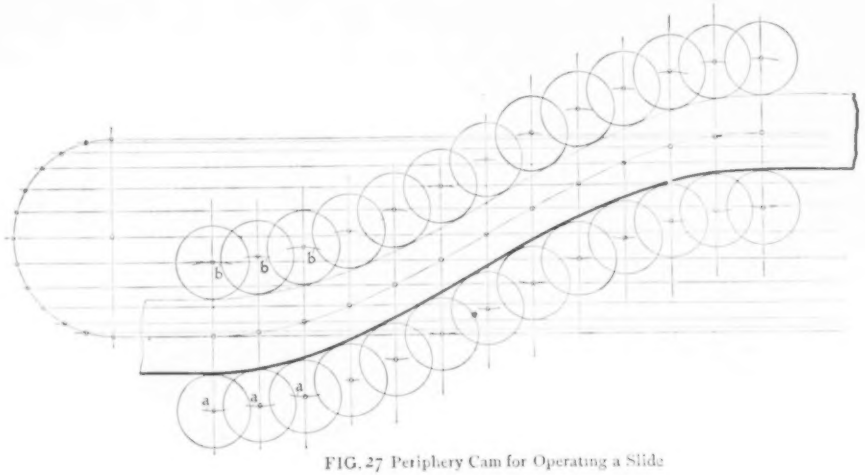


FIG. 27 Periphery Cam for Operating a Slide

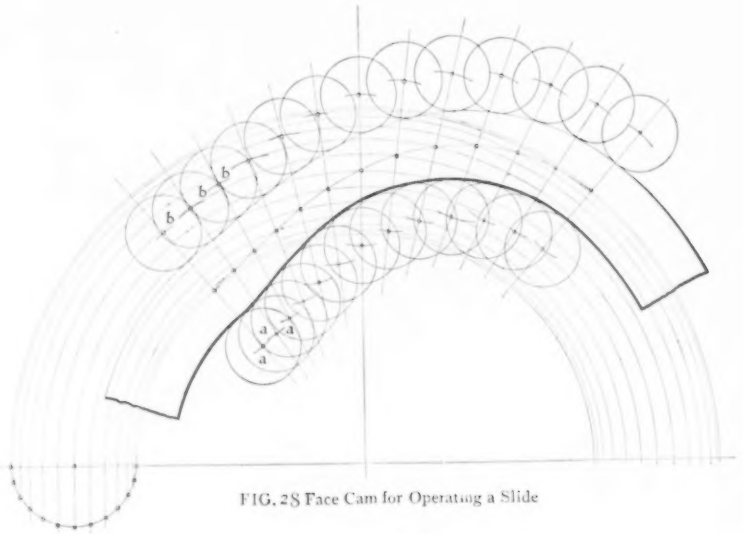


FIG. 28 Face Cam for Operating a Slide

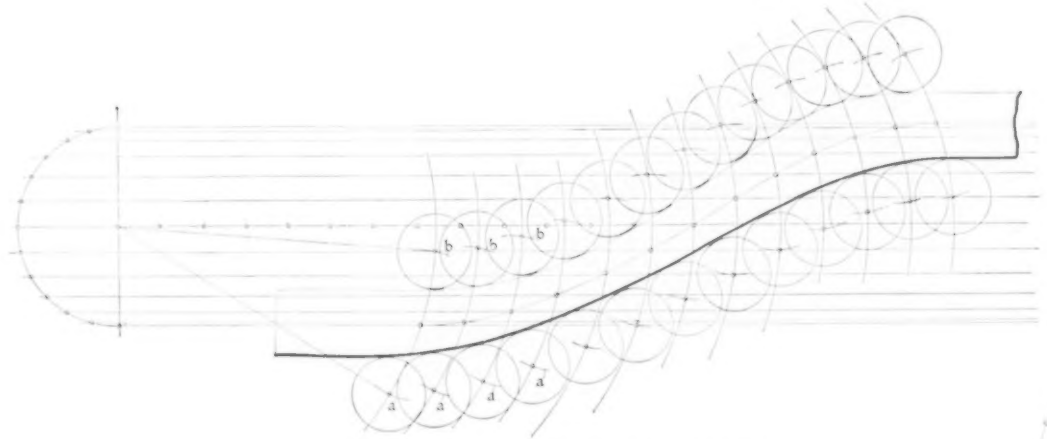


FIG. 29 Periphery Cam for Operating a Pivoted Lever

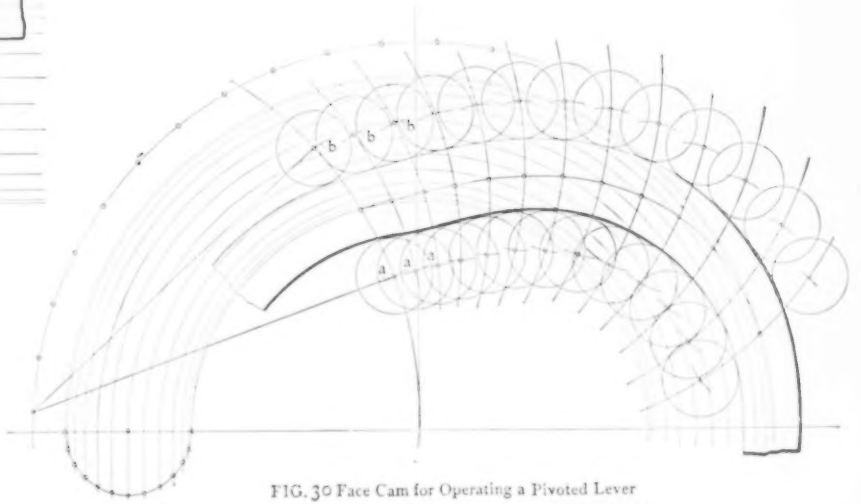


FIG. 30 Face Cam for Operating a Pivoted Lever

American Machinist

RAISED PATHWAY CAMS WITH TWO ROLLERS.

The length of the radius arm *a b* is taken in the dividers and the circle *c d e* is found such that the arc *f g* struck from it with the length of the arm as a radius shall pass thru the center of the cam shaft and the cam curve is laid down, precisely as with face cams.

Fig. 34 shows a fixture for milling conical cams. The former is shown at the left, its stop, which represents the roller, being behind the former and having its

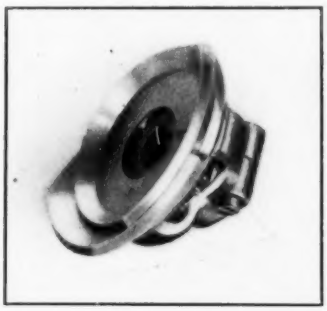


FIG. 35. ADJUSTABLE CONICAL CAM.

edge parallel with the milling cutter and rounded to the same radius. Its length, together with that of the cutter, must be such as to reach the inner portions of the cam. Of course a roller might be used here as in former cases, but with this cam it is not done, as the cam has a spring return and hence but one acting edge. Contact of the former with the stop is maintained by a spring within the tube at the left, this spring acting upon a long center and causing the former to follow up the stop.

This particular cam is of additional interest, as the beginning and ending of its movements are adjustable, a feature which may be used with spring return but not with cams which give a positive movement in both directions. Fig. 35 shows it to be in two parts, of which the circular portions or dwells overlap, one part carrying the beginning and the other the ending of the movement. The two parts are secured to the shaft and to one another by split grips and bolts, as shown.

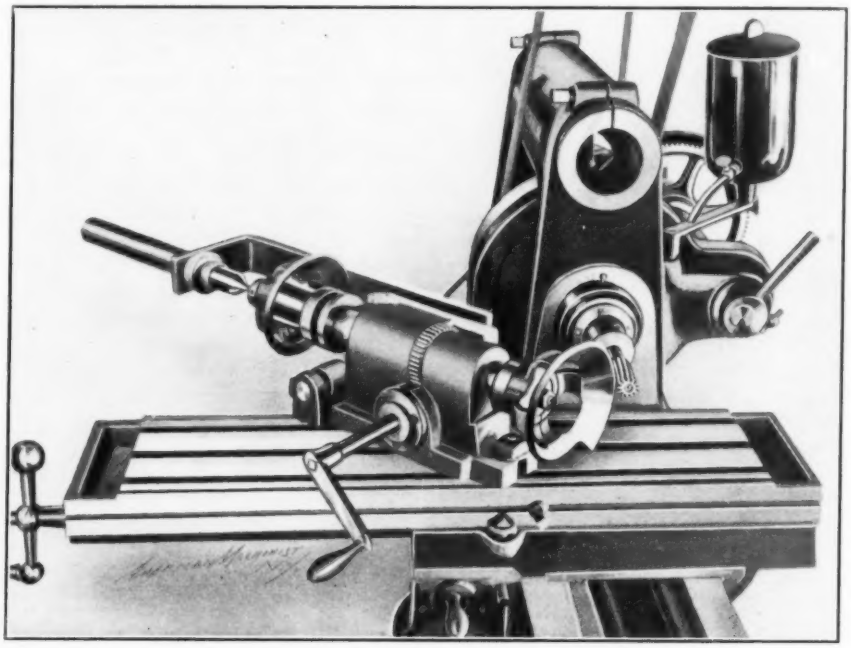


FIG. 34. FIXTURE FOR MILLING CONICAL CAMS.

As an indication of improved business conditions, a leading machine building house informed us recently that a year ago they received an average of two applications for work a week from draftsmen, but that they had not received a single such application during the past five months.

Two Flywheel Accidents.

The latest monthly bulletin of the Fidelity & Casualty Company, of New York, tells of two noticeable flywheel accidents. At Providence, Maryland, a wheel on a Corliss engine went to pieces. It was a belt wheel 16 feet in diameter, 31 inches face and weighed 16,000 pounds. It was made in halves and had the usual bolted and flanged rim joints midway between the arms. Both of the rim joints, together with sections of the rim extending nearly to the adjacent arms, were thrown out and hurled across the engine-room, while the remaining portion of each half remained in place and continued to revolve until the

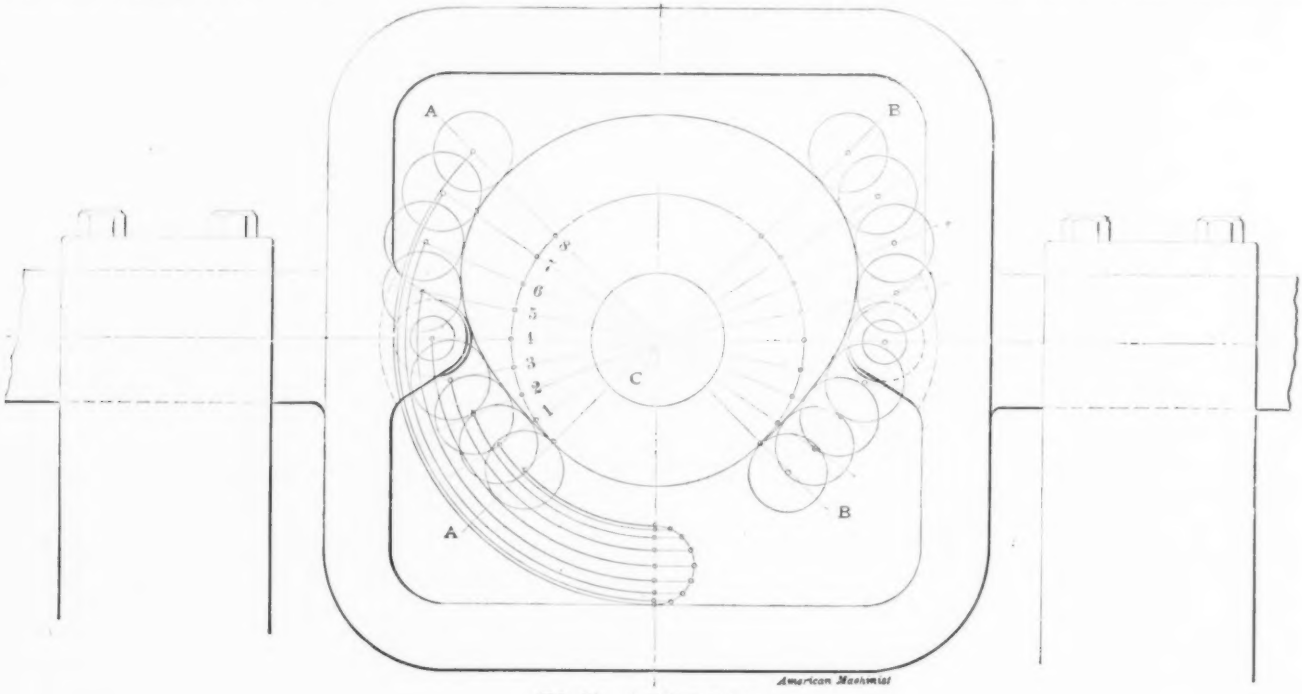


FIG. 31. A YOKE CAM.

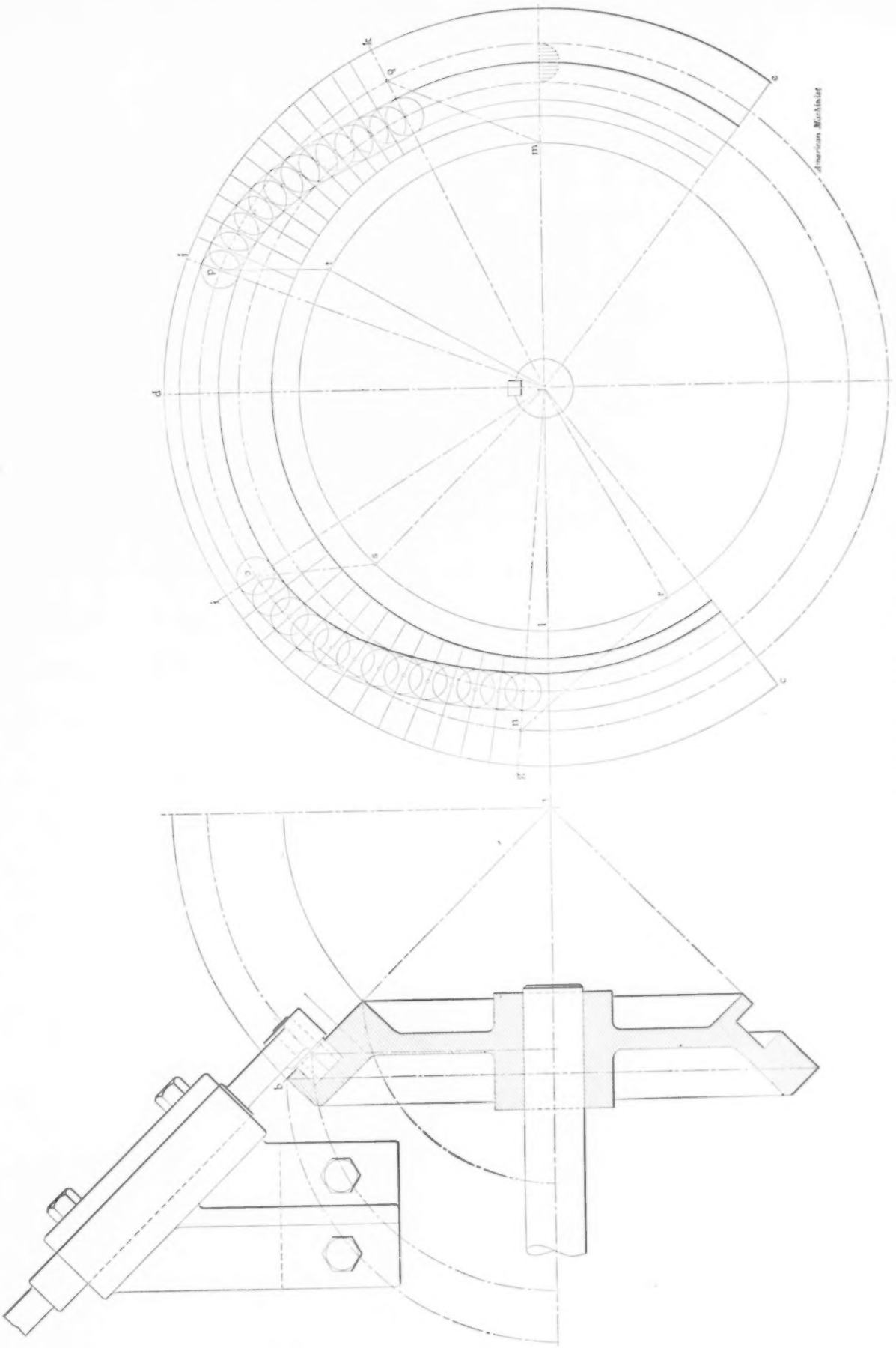


FIG. 32. A CONICAL CAM OPERATING A SLIDE.

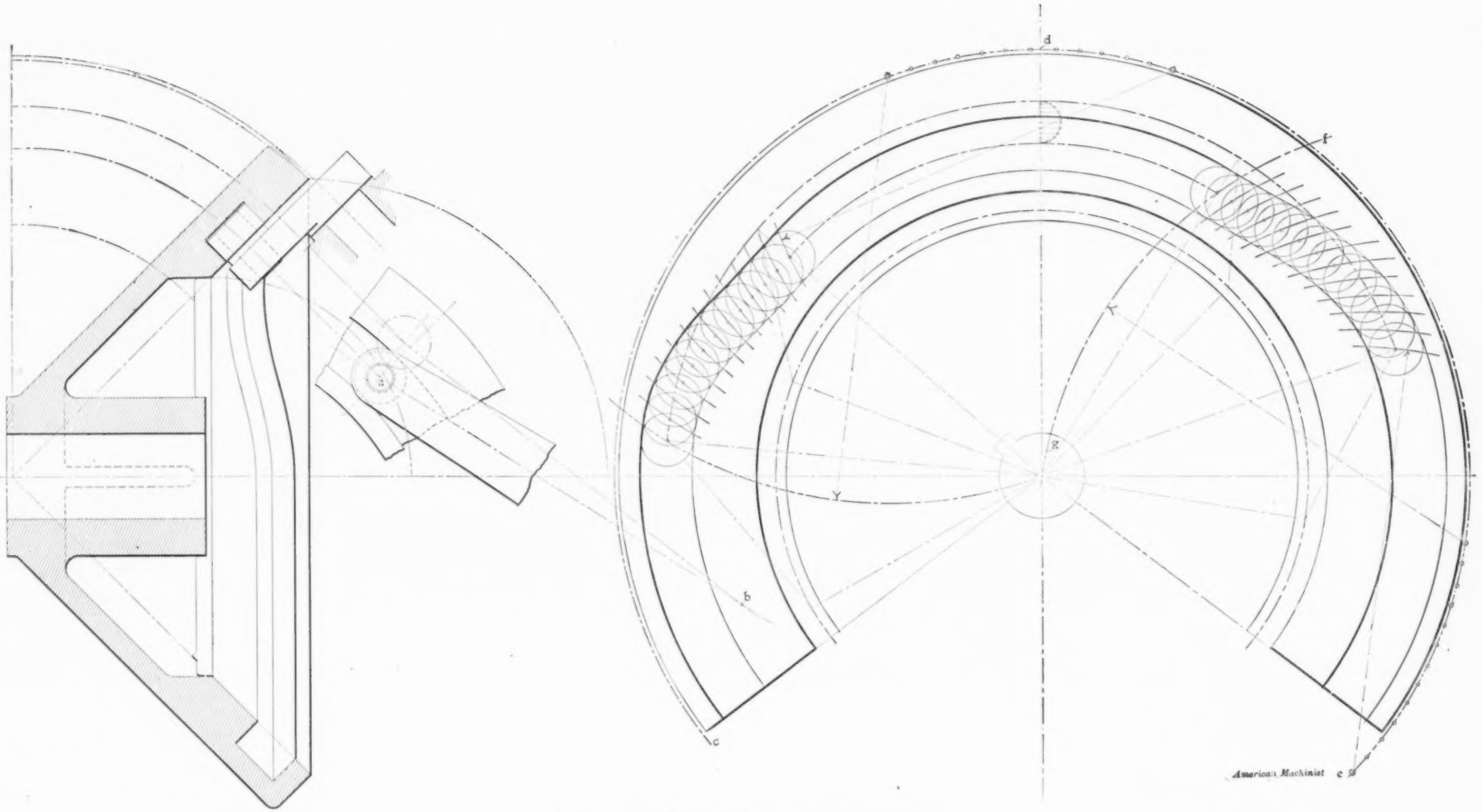


FIG. 33. A CONICAL CAM OPERATING A RADIUS ARM.

steam was shut off. The joints were not pulled apart. The fractures showed a discoloration over about one-half the area of each end, showing that cracks had existed for a long time and oil had worked in. The cracks were evidently produced by the centrifugal force of the heavy rim joints.

At a cement works at Howe's Cave, N. Y., three wheels upon the same engine shaft "went to pieces all at once," completely wrecking the engine and doing great damage to the building but injuring no one. These wheels were not heavy; two were belt wheels made in halves 8 feet in diameter, with rims 13 inches wide and 1⅛ inches thick, while the third was a flywheel 8½ feet in diameter with a rim 7 inches wide and 4½ inches thick, a single casting weighing 3,700 pounds, while the belt wheels each weighed a ton. A key had dropped out of a miter gear driving the governor which stopped and the engine ran away. The crankshaft, together with the crank disk, the eccentrics, the hubs of the exploded belt wheels, and the unexploded balance wheel, was hurled from its bearings clear across the engine-room. With them went the outboard pillow block, eccentric rods, connecting rod, crosshead and piston rod, the accident thus literally dismembering the engine. The balance wheel was not burst by centrifugal force, but was broken by its collision with the cement floor of the engine-room. A remarkable circumstance in connection with this accident is that the two dynamos driven by the exploded belt wheels, and in direct line with them, were not damaged.

Echoes From the Oil Country—The Gas Engine—Some Good Result From Things That "Just Happen."

Once a small boy was asked the cause of some occurrence and he replied, "There wasn't any; it just happened." I sometimes think that as far as any planning goes there are lots of things that "just happen," and some of them are very good things, too.

Once when work was scarce it was noticed that a certain man's steam engine was in very bad condition. From the looks of the exhaust it was plain that the cylinder needed reboring, and from the way the engine rattled it was very evident that there were lots of other places where a little attention would not hurt.

"You would save a lot of money by having that engine repaired."

"Maybe I would, but I am too poor to have it done now. When the price of oil goes up a little I will think about it."

"The poorer you are the more reason for getting it done. The saving in coal would more than pay you."

"That sounds all right, but somehow the savings you fellows figure out so nicely on paper don't seem to leave any more money in a man's pocket."

"I'll tell you what I will do. I'll repair that engine for the saving it makes in your coal bill in the next three months."

He did not really want to get the engine repaired even on those terms, but did it partly as an act of friendship, and to help keep the men in the shop going. At the end of the first month he came in and insisted on paying the bill in full. The saving of coal was so great that it would have been a very expensive lot of repairs to have paid the other way. It had nevertheless been hard work getting him to have the work done.

Not long ago the packing had blown out of the cylinder head of an engine up the run, and after wooden plugs had failed to keep in the steam enough to allow a man to stay in the shanty the owner had started to take off the head so as to put in a new piece of packing. It had evidently been many years since that head had been off, and a couple of the tap bolts had twisted off instead of unscrewing. The owner had come very reluctantly to the shop to get a man to drill out the bolts and pack that head.

"The wells are so small that it hardly pays to run them. If I had to hire a man to pump them I wouldn't have anything left, and as it is I just about get only decent pay for my work. I have a little gas, but I have to burn a lot of coal, too, and it takes so much of my time that I can't do anything to keep things up on the lease." This, and more of the same nature the man confided long before the wells were reached.

When the cylinder head was taken off it was found that the piston was in bad shape. The rings were of the old three-ring variety intended to be set out with springs, but for a long time they had been corroded fast and had hammered together until they were about a sixteenth of an inch loose, and let the steam blow freely by. In trying to get out the follower bolts so that the springs could be straightened up and the rings set out, one of them was twisted off and loud were the lamentations of the owner when he was told that the piston would have to be got out and taken to the shop. Altogether it took only a f w hours' work and a few bolts to get everything in fairly good shape. By the time the owner came in to pay the bill he was in very good humor because he by that time had found out that his gas furnished enough fuel to keep his engine going and he was saved the cost of the coal and also the labor of shoveling it; but it had taken hard work to get him to look ahead far enough to see it before the work was done.

One day a man who had charge of a mechanical establishment dropped in to see a friend, and by some means the conversation drifted on to the cost of power needed to run various plants. This friend was in the gas engine business, and from the various necessities of his business he had often to consider the cost of power under varied conditions.

"Do you think I could save any money if I undertook to run our works with a gas engine?" the visitor asked.

"How many pounds of coal do you use to the horse-power, and what does it cost you?"

"I really don't know how many pounds. It costs me $1.50 per ton, and last year we paid $1,800 for it. We have more power than we ever use, as the engine will give us 200 horse-power on a pinch, and we do not average more than half of that."

"I am not much of a coal man myself; but of course you buy your coal by the car load. When you buy it that way do you get a long ton or a short ton for your $1.50?"

A puzzled look came into the visitor's face. "That is something that I never thought about, and I can't tell. I just thought that a ton of coal was a ton of coal, if I ever thought of it at all."

"We will call it the short ton to be sure, and figure back. Eighteen hundred dollars will buy you 1,200 tons, and 300 working days to the year would give you 4 tons a day. This gives you 800 pounds per hour, and using 100 horse-power would mean that you are using 8 pounds of coal per horse-power hour. Don't you think that is a little more than should be used with reasonable economy?"

"I am not much of a steam engine expert, but if anyone is getting near what we read about, I must be away off. There is one thing about a steam plant, tho, that I never liked. You have to guess at too many things. When you speak to the fireman, it is the engine that is at fault, or the boiler is not rightly designed for the kind of coal he is using, or some other equally good excuse. Of course he is doing the very best that anyone could do under the circumstances that are not under his control. When you go after the engineer, you find that the engine is in fine condition, altho he may not think well of that particular style. If there is anything wrong about the power end of the place, it must be at the boilers. When he hints that he can supply you with a very good fireman instead of the one you now have, you remember that some relation of his has been around looking for work. In the end you get back to where you started, without having done anything. I guess everyone who is using only a small amount of power is in the same fix. What do you think about it?"

"Put in a gas engine, by all means, and you will be at the end of your troubles. At the last end of some kinds, and at the front end of others. There is one thing sure, tho; you will never use two or three times the gas you ought to without hunting down the cause.

"With a good gas engine capable of running your works you should get a brake horse-power for about 80 cents a month, with a reasonably steady load and using natural gas at 25 cents per thousand cubic feet. It should not go over a dollar even if you put in a 200 horse-power engine and have an average load of 100 horse-power only, and run 260 hours a month.

"If your gas bills should come in for a few months at about $99, and then they should change to $105, I am thinking I can see you going around with fire in your eye and a determination to find where those six dollars went to or know the reason why they have to be paid."

"I don't think you should find fault with a man for wanting to get all that is coming to him," said the visitor; "six dollars saved in one spot is quite an item."

"It isn't the size of it that makes you so willing to try to save it, tho, but the fact that it is so much easier to run down than the coal bill is. It takes both money and time to test a steam plant, and after you get it tested it takes more money and time to keep it up to where the test shows it can be worked. In most plants it is not even known what the costs of the power plant are—that is, day by day. With a gas engine all that is changed. All that is needed is a meter on the gas line. With this arrangement any man who can read the meter and do a simple sum in arithmetic can tell what his power costs him, minute by minute, if he wants to know. Even if he is not at all inquisitive, the gas company will be very regular in sending in its bills, and it is very easy to compare one month with another.

"If there is an increase in the gas bills, nothing but finding a leak between the meter and the engine will save the reputation of the latter. Indeed, when you come to think of it, there are several things that may make a difference without it being the fault of the engine. For instance: the

quality of the gas may change; an improper oil may be bought because it costs less, or simply because the importance of the proper kind of oil is not thoroughly understood; the man in charge may be turning on *more* gas than is necessary and so not get perfect combustion; the engine may be 'tinkered' with, so that it is not in proper adjustment; the engine may not be kept clean inside; it may be run too hot or too cold. The engine should not be blamed for any of these things, but it often is until the maker demonstrates that the blame is being put in the wrong place. I think, taking all the steam engines in this country that are under 50 horse-power, that twice as much fuel is used to run them as would be needed under good conditions. I have heard of places where tests have shown that 30 pounds of coal were being used per horse-power hour. If an engine is supplied with 8 pounds of steam for each pound of coal burned, such an engine would use 240 pounds per horse-power hour, or just about ten times too much. Just shut your eyes and try to imagine the actions and language of a man who should get a gas bill that showed that his engine was using 120 cubic feet of gas per horse-power per hour. No need to urge him to have it fixed. He will attend to that without any urging, and also see to it that the maker of the engine is given to feel a realizing sense of the depths of degradation to which his engine has sunk.

"When people get to where they are singing the praises of those who have benefitted the world by improving gas engines they should not forget the magnificent work of the gas meter. It should at least share the honors."

"From that I seem to understand that you think the gas engine has succeeded because most of us are too shiftless to keep a steam plant in proper shape. Is that your idea?"

"Human nature is human nature. Very few people go out of their way to hunt for trouble. Let me tell you a little story.

"Jake was a steam engine man. He had been all his life, and he was not a young man. One day his employer bought a gas engine, and it was part of Jake's business to run it. It ran day and night just as the steam engine had done. Jake hated that gas engine as only a steam engine man can hate one. He cursed it loud and long; he cursed the man who bought it; he cursed the man who made it; he cursed the man who 'got it up,' and he was not at all particular who heard him do the cursing, either. He had to see that it kept going. If it stopped in the night he had to get up and start it again. He gave it just as little attention as he could and hold his job, and it was not many months before it had to be sent to the shop for repairs, and while it was there Jake had the steam engine and boiler to again do the work. The owner told the foreman of the shop not to hurry about the repairs, as he thought it would be a good plan to let Jake have a chance to cool off a bit before the engine was sent back, and it was allowed to stand for some time before anything was done on it.

"One day Jake met the foreman on the street. 'Is that engine 'most done?' he inquired. 'No, not yet,' answered the foreman, as he hurried away. He did not want to hear Jake's opinion of the engine. He had heard it too often to find it interesting.

"In a few days Jake came to the shop inquiring about the engine, and he pressed his inquiries to the point where he found that the work was not started, then he expressed his opinion of the shop and of the foreman.

"'Why,' put in that worthy, when he could get a chance, 'I thought I was doing you a favor by keeping it here as long as ever I could.'

"'Favor nothing,' snorted Jake. 'Do you think I have nothing to do nights but set up with a darned old steam boiler? First it blows for low water and I have to dig out of bed and go down half dressed for fear it will burn the crown sheet, and after the blamed pump condescends to take hold, and I lay down on the bench while she fills up, the first thing I know the water is coming out of the safety valve. By the time I get the water down and the steam run up and the engine started again I am so mad and wide awake that it isn't any use going to bed any more. I wouldn't work for a man that didn't have git up enough in him to have a gas engine, and if you don't soon get that one finished I will come in and these folks will have to have another foreman when I get thru with you.'

"It was the human nature working."

"I certainly will have to consider putting in a gas engine," said the visitor as he started away.

It "just happened" that it is so easy to keep track of the fuel cost of a gas engine.

W. OSBORNE.

Summer School of the Agricultural College of Michigan.

The summer school of the above college will open June 28 and close August 9. The courses of study offered cover steam, gas and other heat engines, materials of construction, applied electricity, mechanical drawing, bench and machine work in wood and iron, foundry work, forge work and special instruction in arithmetic, algebra, geometry and trigonometry. The entire outlay for expenses of attendance, not including transportation, is estimated at sixty-five dollars. No specific entrance requirements are imposed, tho the student should have a fair knowledge of the English language and of elementary arithmetic. For further information apply to Charles L. Weil, Agricultural College, Michigan.

Molding a Jet Condenser.

BY JOSEPH HORNER.

For molding the condenser described, with the patterns and core boxes for it, at page 492, a three-part box is used, tho it might be made by bedding in. In either case the actual molding is not a very difficult job, the principal work lying in the cores. It is hardly necessary to go thru the making of these before describing their setting in the mold, so remarks on the core making and the core setting can be offered together.

Fig. 1 shows in plan the first stage of the coring up, the cores first in place being those for the water space *C*, made from the box, Fig. 9 in the preceding article. *f* is the space recessed on one side for the injection pipe to pass thru. These cores fit into the print impressions *D D* of the pattern Figs. 5 and 6 of the previous article, and abut at the middle of the mold. They are made on grids, cast with perpendicular rods to support the sand and indicated in Fig. 2. Cinders occupy the central portion of the larger section of each core, and vents are brought out into the bottom of the mold.

Fig. 2 illustrates the mold completely cored up, in which, with subsequent plan views, the due relations of the cores can be studied. The core for the exhaust steam chamber is marked *A*, the same as the chamber is designated in the drawings of the casting in the last article. It is made from the box, Fig. 10, and drops into the print impression *E* in Figs. 1 and 2. The view in Fig. 3, taken against the ends of the cores, with the box end and the side of the mold supposed to be removed, shows the core *A* in its relation to the cores *C C* in the transverse direction. This core *C* is rammed up on a grid, with sundry rods cast in, and nails are inserted at the angles of the sand. An open space is left in *A*, see Fig. 5, about the central area and over and around the bosses *j j* for the insertion of the cores *G G*, which form the holes for the pump barrel. These are inserted at a later stage, subsequent to the insertion of the cores *A* and *B B*.

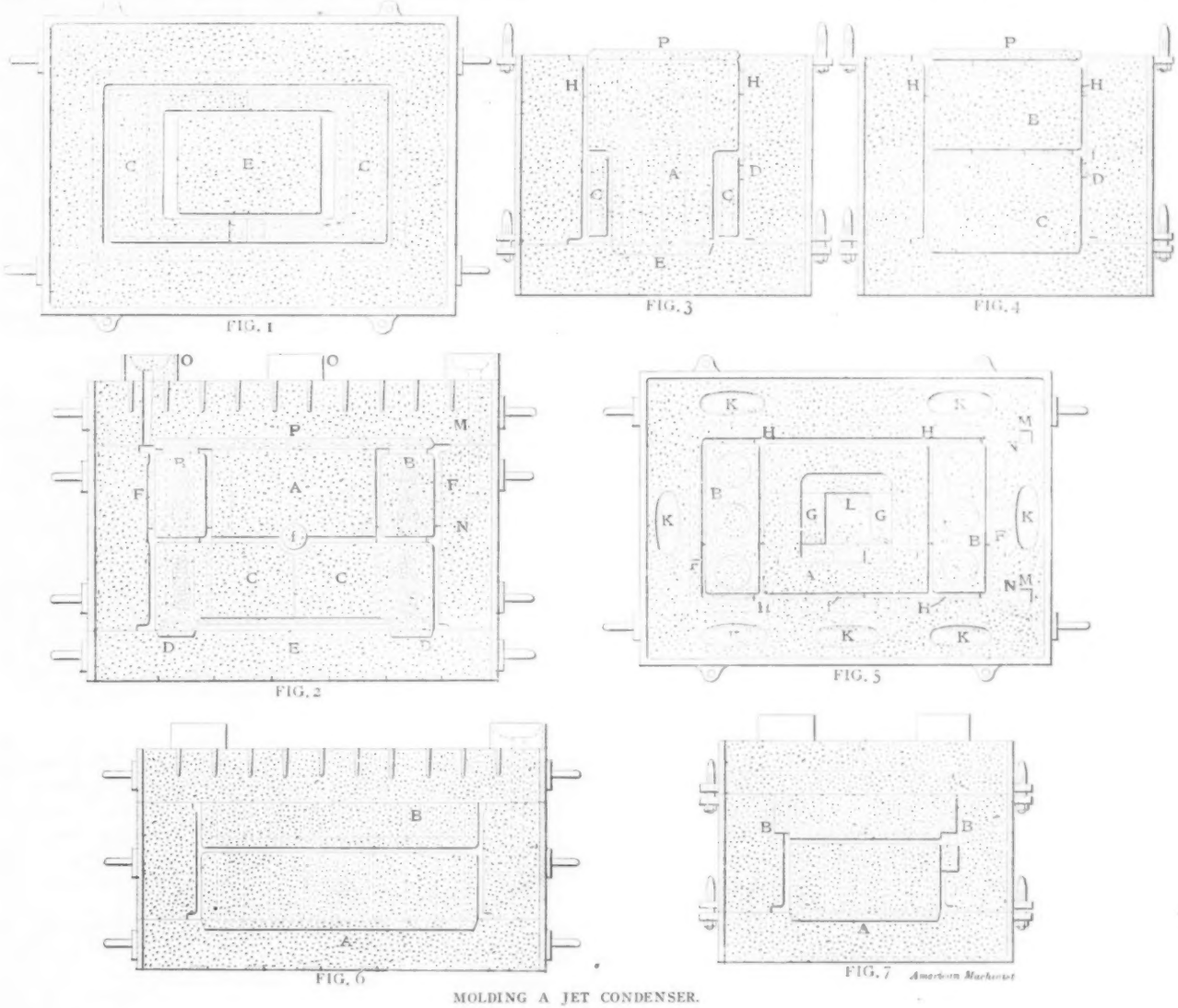
The next cores to be set in place are those for the valve chambers *B* made from the core box Fig. 11 of the previous article. These are seen in Fig. 2 and in the end view, Fig. 4, supposed to be taken against the ends of the cores, with the end of the mold and box ends removed. They are also shown in Fig. 5, which is a plan view of the mold with the cores in place but with vents still open and before the cope is put in place.

Looking at the cores *B* in these views it is seen that no prints are employed for them, the cores being set in partly by measurement and partly by the thickness of the cores for the openings that are inserted into the outer portions of the mold. The cores for the valve seatings, made in one with *B B*, give the thickness at bottom and

top. The other cores which give the thicknesses at the flanks are the following, the reference letters being the same as those employed on the drawings of the casting Figs. 1-4 in the last article. They are: *F F*, holes cast in the ends, thru which the brass pump barrel is inserted, in the holes *G G* in the bosses *j j*; holes *H H*, thru which the hands can get at the lower valve seatings (the upper ones being reached from above); the openings *f* for the injector pipe, *J* for the overflow and *D* for the feed pump. The locations of these are indicated in the drawings of the mold. The plan view Fig. 5 of the mold, cored up but not covered, shows how the vents of the upper main cores are taken away, being brought into the recesses *K* and thence out at the box joints. The vents from the main central core *A* are taken up thru the space *L*, which is filled with cinders after the cores *G G* have been inserted thru the space *L* into their print impressions in the bosses *j j*. These occupy portions only of the hole made by the continuous print in the box Fig. 10 of the preceding article. The length of this is sufficient to permit of the insertion of the two short cores *G G*, seen in Fig. 5, and of their thrusting along to touch the cores *B B*, after which the hole *L* in core *A* is filled up.

These cores are all covered with the plain core *P* seen in the sections, Figs. 2-4. The mold is run thru the in-gates *M* and runners *N*, along the sides, clear of the small cores. Risers are put on at *O O*. Figs. 6 and 7 illustrate the mold of the base casting; the drawings show the details of coring. The bottom core is carried in a flat print *A*, the top one in the side prints *B B*.

Bath, England.



MOLDING A JET CONDENSER.

How Metals May Grow.

How does a plant differ from a lifeless mineral or metal? The plant possesses the capability of growth, of absorbing nourishment, and the power of propagation. We deny such powers to inorganic bodies like minerals and metals. And yet a mineral can grow! By introducing an infinitesimal alum crystal into a solution saturated with alum the crystal will continue to grow. By introducing two sheet-copper strips into a solution of copper (*e. g.*, blue vitriol) and allowing an electric current to pass thru the liquid from one strip to the other, the latter strip will be found to assume a continuous growth.

The necessity of applying fertilizers for the purpose of attaining certain kinds of plants is simply an artificial process for supplying conditions necessary to growth. But to the production of snowflakes by the growth of ice crystals exposure to special atmospheric conditions is equally necessary. The majestic glaciers in our mountains are the accumulated growth of tiny ice crystals.—Prof. E. Heyn in *Harper's Magazine.*

How far any people have got beyond Adam and Eve—and in what direction—are serious questions. It will probably be some generations, and it may be many, before the Indian masses, still steeped in ignorance as well as in agriculture, will be able generally to assume that position in the oversight of mechanical appliances which admits of labor-saving machinery such as is common in Britain and in America. You can no more forestall the slow movements of nations handicapped with adverse conditions than you can make the sun stand still in order to telephotograph its spots.—*Indian Engineering.*

Shop Tools and Devices—II.

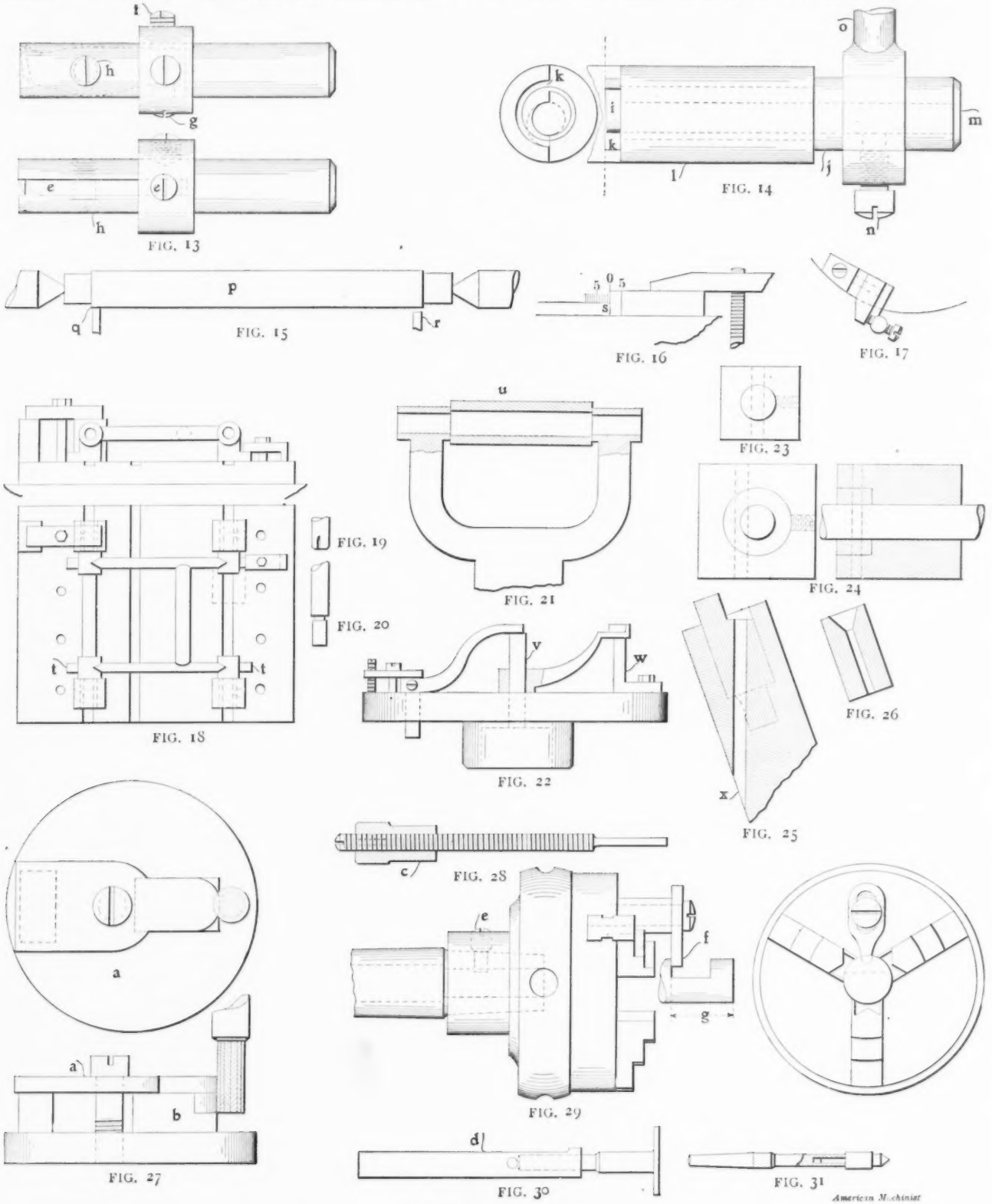
BY F. J. LE CARD.

I use a tool like Fig. 13 with the best of results in a drill press for boring out drilled holes true for reaming. The work is held in a Brown & Sharpe graduating chuck on a press with cross-slides on the bed and all the holes are finished before removing the work. The cutter *e* is adjusted by the screws *f* and *g* and locked with *h*.

A RECESSING TOOL.

In Fig. 14 the cutter *i* eccentric to the sleeve or shell *j* was used to cut a channel at the bottom of a recess at right angles to the hole entered by *j* and at the end of the hole. This recess contained a disk and the cut shown at *k* could not be reached from the front. The cutter *i* when placed in *j*, as shown in full lines, could be passed thru the hole in *l*. Then by turning it gradually to the position indicated by dotted lines it cut out the channel to the limit of the eccentric.

By calipering the cutter before using with a micrometer over the cutting edge and opposite diameter of *j* and marking the opposite ends of both pieces at *m*, the cut or throw of *i* can be seen to a



SHOP TOOLS AND DEVICES.

thousandth; the cutter can be set by the slot at *m*. The set-screw *n* passing thru *j* and binding *i* holds both pieces to the line. As I made the cuts by hand, I used a dog *o* to hold the tool.

LOCATING THE SETTING LINES ON A BENCH-LATHE SLIDE-REST.

The manufacturer generally leaves the setting line on the above appliance unmarked so that the user may suit himself as to size and position, some liking a coarse and some a fine line to set the rest by.

See that the shears of the lathe are clean and the slide-rest shoe also, and the headstock and tailstock fast and the centers true and in line. Use an arbor *p* about as long as the travel of the slide-rest. Bring a square-nose tool or Starrett or other indicator in the tool-post against the arbor, as shown at one end, *q;* turn the arbor end for end to be sure of the same diameter, and run the tool or indicator over and try it at same end of the arbor but on opposite center at *r*.

If the slide-rest is shown by the index on the cross-feed handle to be twelve-thousandths, say, away from the arbor, move the handle six-thousandths, being sure that the back-lash in the screw has been taken up. Then loosen the slide-rest swivel-plate and bring the square-nose tool against the arbor, and fasten again. Try the other end again, and to verify turn both ends of a long rod without moving the tool. The same result can be secured with the indicator.

With the slide-rest held in a good light, mark a very fine line *s* by means of a beveled piece clamped to the rest as in Fig. 16; then do the same with the line on the opposite side of the rest.

Even with a very fine line and a closely fitted rest it is not quite easy to set the latter exactly, as the lines on the degree circle are frequently quite coarse. To remedy this, and to get back quickly after turning on an angle, some rests are fitted with a stop like Fig. 17, which can be thrown out when the rest is set on an angle.

A DRILL JIG.

Fig. 18 is a jig for putting parallel holes in cast frames of the type shown. Grooves covering the distances required in several pieces are planed in a plate, and bushing blocks of the desired hights slide in these. The blocks have different bushings in pairs, one for the drill and one for the reamer, held in place by set-screws with tits on the ends to keep the bushings from turning. The bushing blocks are brought against the work for supporting it, and the work once clamped is not moved until all the drilling is done.

The rose reamer, Fig. 19, generally makes trouble, and a better plan is to use one like Fig. 20, with a long guide bushing for the shank which is larger than the reamer.

For light and irregular shaped work like these frames it is good practise to cast on clamping pieces like *t*, which can be removed later.

THE HANDY SOLDERING PRESS.

Fig. 21 shows how a brass tube *u* is sometimes soldered between the arms of a brass frame for bracing the same while the holes are drilled.

Fig. 22 gives a method of mounting fragile, odd-shaped pieces on the face-plate for milling, turning, etc. The supports *v* and *w* are of brass for soldering to. I have seen soft metal figures fastened to aluminum, such as printing wheels in time stamps, etc., where sluggishness of movement is obviated by the lightness of the latter, as follows: A copper wire is placed in a groove in the aluminum and held by closing in the latter metal between the figures. Then with a quick melting solder the figures or letters are fastened to the copper wire.

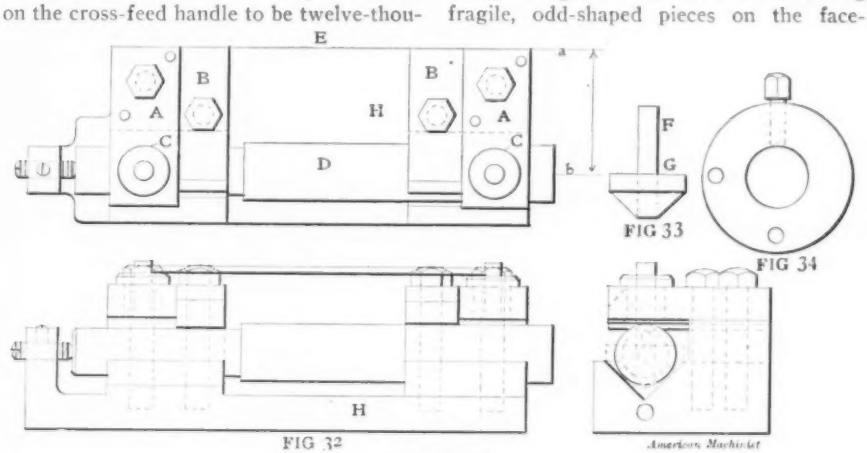


FIG 32 FIG 33 FIG 34

A DRILL JIG.

PRACTICAL HINTS ON DRILLING AWKWARD HOLES.

Fig. 23 shows an easy way to drill round rod, and Fig. 24 how to drill a hole thru the contact of a rod and collar.

Fig. 25 shows a plug inserted in a counterbored hole for drilling an inclined oil-hole in a stationary frame, such as would be used for the oil-well of a hollow center like Fig. 26.

PROFILING IN THE DRILL PRESS.

Small work of odd shapes can be profiled handily in a drill press in the way indicated in Fig. 27, the sample chosen being a piece actually handled in this manner. The piece *a* acts as a clamp and templet in one, being hardened. The work *b* is readily cut to shape with a router or round hand cut file running at good speed and set to hight.

THREE-JAW CHUCK POINTERS.

Figs. 28 to 31, inclusive, explain small three-jaw chuck features that come in my outfit and are put in here for what they are worth to others.

The commonly used 3-inch scroll chuck is one of the most abused and usually out-of-joint articles in the machine shop, and yet one of the easiest to keep in order. It is really a durable tool if given half a chance, but when used to hold a twist drill of the largest size within its capacity, if it is tightened with the regular socket wrench, supplemented with a monkey-wrench or a lead maul, it naturally goes to the bad.

The jaws are made of machinery steel, usually, and case-hardened. They can be given a red heat to soften them, and then may be put in place and bored out in the lathe, giving enough back taper to make them pinch at the outer ends. File the angles down again to a small land where they bind, and re-caseharden. If this throws the jaws out a little, stone off the jaw which needs it, and if out horizontally tighten the jaws lightly on a rod held in a chuck in the tailstock or on a rod with a center on the tail center, and grind out a very little by revolving the chuck on the rod, using emery and oil. It takes but a little pains to make the chuck perfectly true again, and it will remain so a long time with proper treatment.

The stop or gage in Fig. 28 is a screw running in the nut *c* held in the back end of the chuck holder; or, in case of a spring collet, in the chuck itself. The nut, made of brass, is split and pinched at one end to check the screw.

It is easily seen that a scroll chuck is more reliable for end or shoulder cuts than a split or spring chuck which draws the work more or less as the chuck is compressed tightly or loosely.

Fig. 30 is a stop in a taper holder, and the piece shown is very convenient for catching thin work true with the face at the chuck jaw points.

Fig. 31 goes in the same holder and gages the shoulder length, allowing the small end to go by. The holder *d* with flattened side is held in the chuck by a screw at *e*, and slides as required. The gage *f* is held by a screw and collar on the face of the chuck and between the jaws. I had a hundred pieces to gage at *g* and found this scheme to work well. The chuck opens quickly to admit of taking out and putting in work past the gage. This stop is all right for a shoulder gage, as it stands now in the milled cut.

MAKING A JIG.

Figs. 32, 33 and 34 furnish a subject for discussion as to the best way to make a jig like that shown. The most usual

way would be to assemble the pieces *A A* and *B B*, leaving the holes for the bushings *C C* to be made the last thing. In this way the casting being planed as finished and the shaft *D* clamped in place, the jig is placed on the surface plate with side *E* down. The hight is taken from *a* to *b* and scribed on *A A* for the center of the shaft and bushings *C C*. The distance between bushing centers is then found on this line. Then from these points *A A* are swung up on the face-plate and bored out, and the bushings driven in; or, with care and some drawing of the holes, they might be drilled in the press close enough. As it was, I center-punched and drilled everything on *A A* and drove in the bushings first. Then I located them on the casting by putting the pin *F* in the piece *G* and the bushing *C*, placing the former in the "V" of the jig, as indicated by the dotted lines in the end elevation.

By spotting the casting for the screw hole in *H* with a punch that filled the hole in *A* and was held in place by hand, everything came right for the dowel pins.

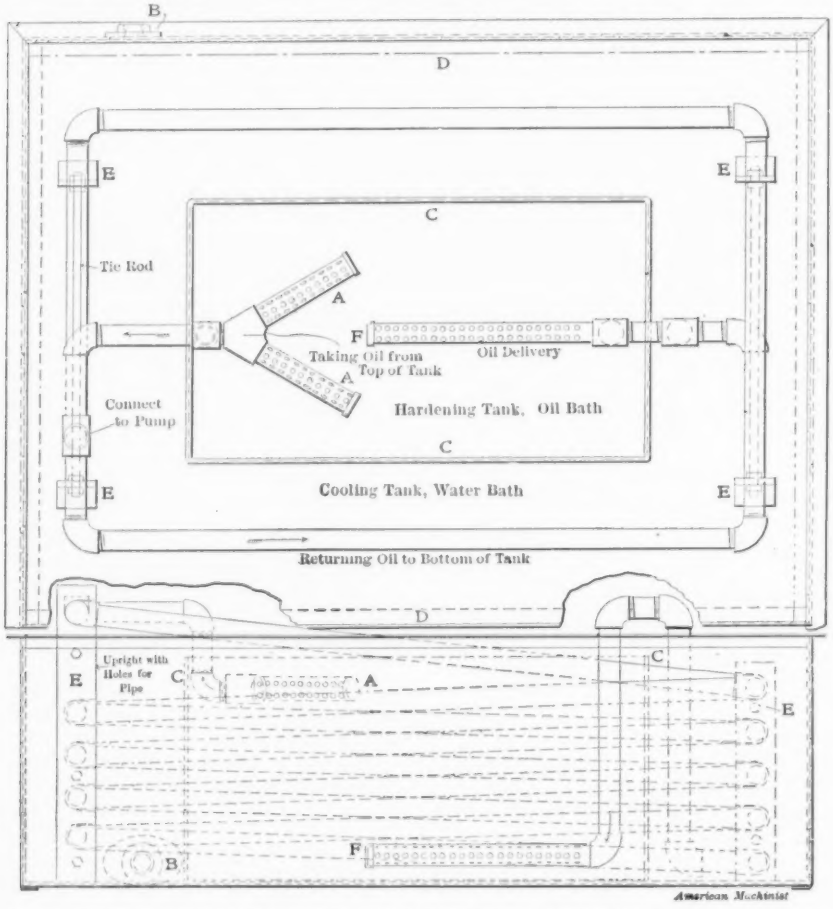
The piece *G* can be made of brass and used for any jig by making the pin to the size needed.

Fig. 34 shows a collar used at end *K* of the shaft for shifting the shaft so as to drill the two holes at any desired angle to each other.

An Oil Hardening Bath and Cooling Tank Used with an Automatic Heating Machine.

BY JOSEPH V. WOODWORTH.

In the cut are given a plan and a side view of a combined oil hardening bath and cooling arrangement which I designed for a large machine manufacturing concern to be used in conjunction with an automatic heating machine using gas as fuel. The articles heated in the machine and hardened in the oil bath were very frail and minutely accurate in construction, being required to be ground and lapped after hardening to within 0.0005 inch. The heating machine was built from original designs, and when completed represented a very radical departure from the methods usually employed for hardening such accurate work. Previous to the installation of the automatic heating machine and the combination bath and cooler, the processes in use for the hardening were so crude and unreliable as to produce a large percentage of defective, inaccurate and imperfectly tempered parts. As all operations on the parts, up to their finishing, were performed at piece-work rates, the perfecting of the heating process and the hardening eliminated much of the subsequent cost and labor formerly entailed, and also accomplished a saving of 60 per cent. of the former cost of hardening. The automatic heating machine had a capacity of 4,800 hardened pieces per day, and it cost $450. As the hardening bath and cooling arrangements gave the most satisfactory results, similar ones may prove adaptable for the hardening of other accurate work.



OIL HARDENING BATH AND COOLING TANK USED WITH AUTOMATIC HARDENING MACHINE.

The cut is almost self-explanatory, and but slight description will be necessary to enable anyone to understand it. The arrangement consists of two tanks: a small one inside a large one. The inner tank was filled to within about 1 inch of the top with fish oil; the other tank was fitted with five rectangular "coils" of piping and was filled with cold water, which was drawn off at the bottom at drain *B* and refilled at frequent intervals. As shown the arrangement of piping is such that the oil heated thru the immersion of the hot parts is drawn off from the top of the bath by the perforated fork pipe or strainer *A A* by means of a suction pump, the connections of which are not shown. After passing slowly thru the coils of piping, the cooled oil is delivered again thru the perforated tube or strainer *F* at the bottom of the inner tank; thus a steady flow of cooled oil upward is maintained, and also a steady removal of the heated oil during the operation of the heating machine.

The principal dimensions are: Inner tank, 33½ by 18½ by 18 inches deep, No. 14 galvanized iron; outer tank, 61 by 36½ by 20 inches deep, No. 14 galvanized iron; 65 feet of 1¼-inch pipe is required, and 15 inches of 1½-inch pipe.

Summer School of the University of Wisconsin.

The fifth session of the summer school of the above university will open June 26 and close August 4. The courses of study offered are engines and boilers, applied electricity, machine design, materials of construction, fuels and lubricants, shop work and manual training. A special effort is made at this school to co-operate with and supplement the work of the correspondence schools, some of which are acknowledged to give "very good and sound instruction along many lines of engineering and mechanical practise." The entire expense of attending the school, including fees and living expenses, but not transportation, is estimated at fifty dollars. No detailed educational requirements are specified for admission, tho a speaking and writing knowledge of the English language and a fair knowledge of elementary arithmetic will be found necessary to profitably follow the course. For further information apply to F. E. Turneaure, University of Wisconsin, Madison, Wis.

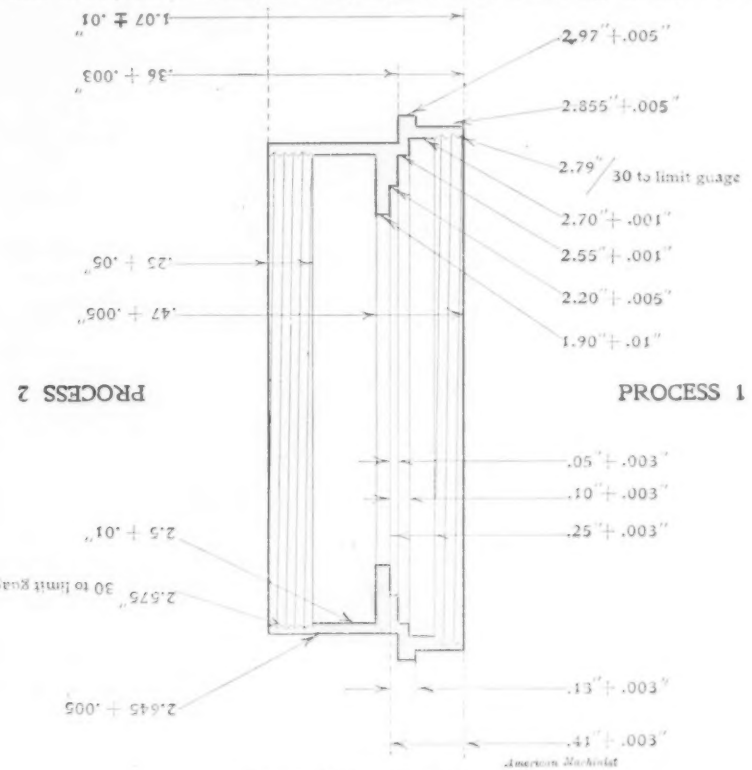
The United States is the leader in the production of pig lead, with Spain next, and Germany third, the output for 1903 being 266,691 tons, 172,521 tons and 141,558 tons respectively. We lead also in the production of pigs.

Letters to the Editor.

The Fixing of Limits—Dimensioning Drawings.

It is easy for the designer of a part, who knows for what purpose it is intended, to fix limits the departure from which means spoiled work. It sometimes, however, happens that for a dimension in which a variation of, say, .005 inch will not directly interfere with the usefulness of the part, a limit of perhaps .002 inch should be amply sufficient for the producing process. Now, if the coarse limit is fixed, the workman remembering the dictum, "Between these sizes is right," will probably roam over the entire range allowed.

The parts will be between the limits of error, and consequently usable, but they



DIMENSIONING DRAWINGS.

will lack that uniformity which is generally desirable and which might probably have been attained with little or no extra effort had a finer limit been adopted. If, on the other hand, the fine limit be fixed and occasionally overstepped, the inspector, who may have a hard and fast rule and may not know just what function the part fulfills, will probably reject usable work. Such cases seem to call for two sets of limits, one comparatively fine, yet within which it is reasonable to suppose the workman can keep with the means at his disposal, and a coarser one for the examiner's guidance. I am inclined to think that for such work this bi-limit system is unconsciously adopted by a good many of us, the coarser limit lodging somewhere in our brain pan under the name of discretion. Someone shows us some parts that are just outside the fine limits; we apply our mental coarse limit and find that tho the workman might have reasonably been expected to do better, yet the parts are commercially good. "Let them go" is therefore our verdict. Exception may justly be taken to this in that it reintroduces the personal element which the limit system was supposed to have removed. It does, and the only way to obviate it seems to be to fix limits in all cases as coarse as the nature of the work will allow, irrespective of the degree of accuracy expected under average conditions.

Where this is done it will generally be found best to express the limits on drawings and instructions, not thus: 1.50" to 1.51", but thus: 1.50" + .01", or 1.51" — .01", or 1.495" ± $\frac{.005}{.005}$, according to requirements, indicating clearly the *desirable* size and the direction in which any deviation from that size must take.

If 1.50" is the right size of a part, and if that part ever so little below 1.49" is spoiled, it will generally be found that at 1.495" the part, tho distinctly usable and within the limits, is yet a little less desirable than if it were, say, 1.499". Therefore tho it would be fatal policy to blame a workman who varied between the limits fixed, still, I maintain it is wise to indicate the desirable point in a limit which is coarse in relation to the tools used.

Some may say that to do this will be to abolish one of the main functions of the limit system, inasmuch as it is intended not only to secure precision in vital parts, but to prevent time being spent in securing on unimportant sizes an unnecessary degree of accuracy.

While admitting that time thus spent is a clear loss to the employer, who is paying for something he does not use, I submit that only in rare cases would this result. Let it be clearly understood that I do not refer to the many cases where the extreme limits of permissible error are barely sufficient within which to keep. To place limits on an already heavily dimensioned drawing without causing confusion is not easy. The accompanying sketch shows the best method I have encountered. It shows a cast brass part which is turned and threaded on a lathe designed specially for repetition work and fitted with suitable stops. One side of these parts is of course turned throughout the batch, which may number a thousand; they are then reversed on a screw chuck for the second process. It will be seen that for either process the only dimensions which can be read are those which concern the worker of that process; this makes the drawing easier to read and defines clearly just what work is to be done by each man.

For either man the views of the part on the drawing and in the lathe agree; they have not to mentally reverse the image.

ALEC W. WEBSTER.

Leicester, England.

Homemade Paper Scales for Draftsmen.

One variety of scales for use on the drafting board that I have used to good advantage and that I have seen in a few architects' offices has not as far as I know been described in print. This is the paper scale—not the kind you buy but made from drawing paper of the same quality as used for pencil drawings. They are made by dividing a strip of this paper about ¾ inch wide and as long as the longest drawing, into even feet at the desired scale; the end division may be divided closer, even to inches or less if desired; I generally use my triangular scale for this portion. All of the foot marks should be plainly marked. The advantages of these scales are: 1. The possibility of being able to read the longest dimensions without setting off from short scales, with the possibility of several errors. 2. The feature of having the scale of the same material as the drawing and subject to the same atmospheric influences; this is not very material in most drawings, but in large power-house layouts, 4 to 6 feet long to small scale it is very noticeable. In these cases it is frequently advisable to make two scales, one running across the grain of the paper. 3. If the end foot is divided, compasses can be easily set to scale in the same manner. Many of us use a short piece of the purchased machine divided paper scale. 4. The ever pleasant advantage of being cheap. After a little practise a scale 6 feet long can be made and checked in 10 minutes, and a bunch of strips of several different lengths to the same scale can be pinned to the wall or window casing by a thumb tack, using

a separate tack for each scale. As soon as one shows the result of wear, a new one can be made without waiting till the "ghost walks." C. J. M.

The Layout and Construction of Cams.

I have read the article on cams at page 343 with much interest, but am much

FIG. 1 Mr. Smith's Construction

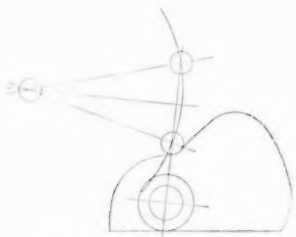


FIG. 2 Textile Machinery Construction
American Machinist

surprised that the author advocates the location of the fulcrum of the lever for a face cam so that the center of the roll would pass thru the center of the cam as in Fig. 1. Textile people are frequently compelled to design a cam where such a course would produce working angles that would cause the cam and lever to lock when the cam rotates toward the fulcrum of the lever. Fig. 2 shows the approved textile style, and certainly the lines of force are better—*i. e.*, more favorable—with this construction.

CLINTON ALVORD.

The articles on cams by Charles F. Smith have reminded me of some notes on cams I had planned to send in to the AMERICAN MACHINIST, but which I have neglected until now.

In choosing the character of motion of the roller which is operated or controlled by a cam, it is quite common to choose the crank-motion curve, explained by Mr. Smith. The reasons for choosing this motion are that the point moved, starts from rest, is gradually accelerated to the center of throw, then as gradually retarded the same as the crosshead of a steam engine fitted with a Scotch yoke or slotted crosshead. This ordinarily works very nicely, but there are cases where a motion developed from some other curve will give better results.

In order to make this clearer, I will state a little difficulty I had last year, and how it was overcome. In a certain machine which I designed, it was desired to move a crosshead, or slide, guided in ways, back and forth, and it was necessary that at one end of its traverse it should come very accurately to a definite location every stroke. Some little variation could be allowed on the back stroke, but it was desirable to also keep this nearly uniform. The motion was to start from the back position, move rapidly forward to the front position, dwell for a very small fraction, then return and dwell while other parts of the machine performed their movements.

The movement of the slide was 34 inches, and this was derived from a cam of 4 inches throw, the motion of the cam being multiplied by levers to give the 34 inches.

The cam was 14 inches diameter, of the face variety, with a roll of 1½ inches diameter.

The machine was wanted to make thirty to forty strokes of this slide per minute.

The groove for the roll was cast, and the roll was turned to fit the tight places of the cam, which would be called a pretty fair cast cam; but when the machine was started it pounded so badly, at even twenty to twenty-five strokes, that it was seen something had to be done at once.

The cam could not be made of larger diameter without changing the frame of machine; therefore the change had to be made in the path of the cam.

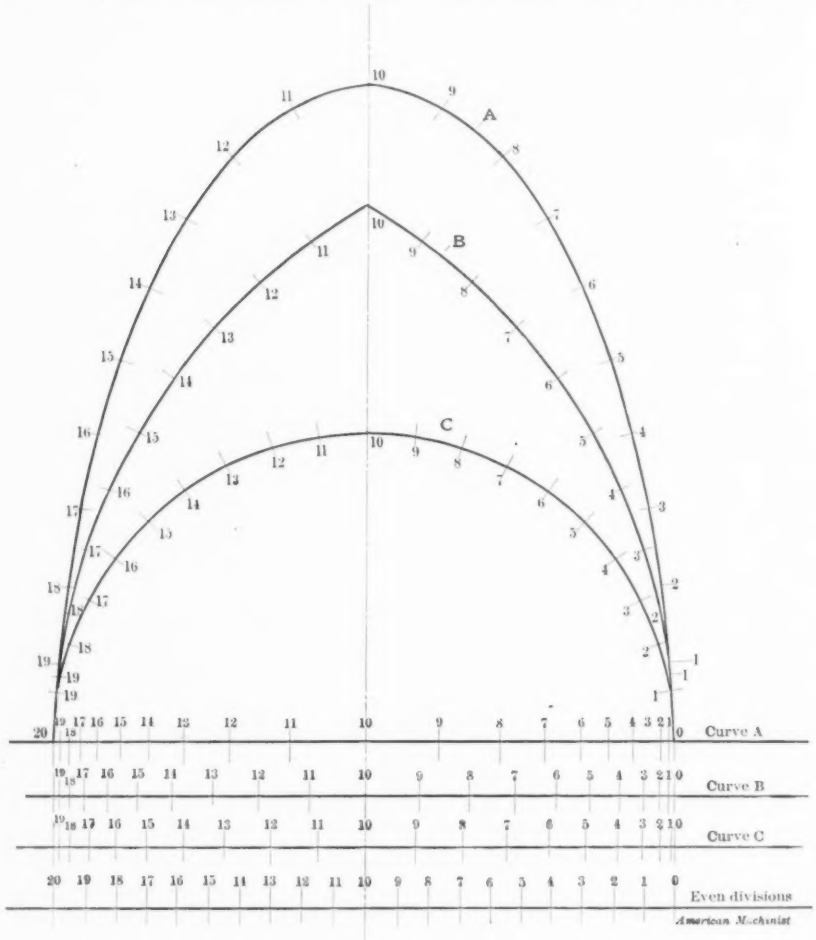
The first cam was constructed according to a crank curve, as shown by curve *C* of the illustration. Dividing the semicircle into twenty equal parts, and projecting these to the base, gives the rise for equal arcs of movement of cam, as shown.

After some thought, the compasses were placed on 0 and 20, and arcs struck with radius 0, 20, which intersect, as shown in curve *B*. By dividing *B* into twenty parts, as before, and projecting as before, we get the base line of curve *B*. By comparing, point by point, with *C*, it is seen that the motion is quite different.

It might at first be supposed that by choosing an even longer radius than from 0 to 20 a still easier motion would result. It will, however, be found that the length of the curve from 0 to apex increases as the radius increases, and that for any radius equal to 0 to 20 or more, the base will be divided exactly the same.

A cam was constructed on the base line thus obtained, and the machine ran very much better.

At this time along came a party who owned a similar machine, and claimed he could run it at sixty strokes per minute. Since at this speed the slide would have to make a stroke out and back in about two-thirds of a second, and dwell one-third, we thought he was blowing off a



VARIOUS BASES OF CAM CURVES.

little hot air; further we had reason to believe the stroke of his machine was less, but we determined to make one more change, since we intended to do *as well* at least as other people.

In the first two cams the roll moved from the outside toward the center of cam in order to move the slide forward, which gave some lost motion at the extreme forward point. The new cam was modified, so that the roll moved from the center of the cam toward the outside when moving the slide forward, which nearly did away with lost motion at that point, where it was most objectionable. By changing the frame slightly, we made room for a cam 18 inches diameter, and we increased the throw to 5 inches, which cut our ratio of leverage down slightly, and the cam roll was increased in diameter to 2 inches, and then came the question of how the base line or motion line should be divided.

It was thought that if a parabola were chosen the roll would move according to the law of falling bodies, and would be retarded by the same law. On trying this curve, it was thought the change in velocity from zero to the center was too great, and that it was not slow enough at the ends. While thinking this point over, our eyes fell on an irregular curve which looked about right, and curve *A* was drawn in, divided as before and gave the base line marked curve *A*, and the cam was made to this curve.

The other cams had given so much trouble that we determined to see this one properly fitted up, so we stood by the workman while he filed and scraped this cam till the roll fitted close all the way around.

There is no question but that the action of the machine would have been improved in the first place if the cam had been properly milled in a cam cutter, using a leader; but we did not have either, and it was not the practise at this shop to fit up cams this way. "It cost too much," they said.

When this cam was started up the machine ran so smoothly that, with the back turned to it, one could not tell if it was running; consequently, it was speeded up, and by adjusting a little it ran up to sixty strokes per minute, and as smooth as one could wish. At this point other parts limited the speed and not the action of the slide.

On examining the base line, it is seen the speed is started very slow at the start, very fast at the center, and then gradually arrested. With the crank curve the speed was too high at the start and finish, causing the banging at ends.

The curve finally chosen was nearly an ellipse. I have been explicit in above, for I think that often sufficient thought is not given to the character of motion of cams, and that often a different generating curve would be an advantage. The curve *B* has the advantage of being very easily constructed, and is intermediate in rate between *A* and *C*, and would often be good enough and better than the crank curve.

I might add that the performance of the first machine with the last cam was so satisfactory that three machines were added to the original order of three, and this was followed with a repeat order for three more, making nine machines built to date, in addition to the experimental machine.

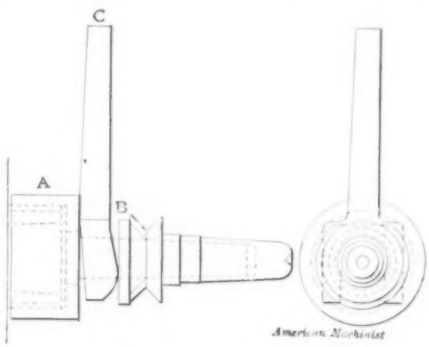
The inability to run the machine at high speed at first threatened to make the whole machine a failure.

Care must be taken that the path from 9 to 11 is not at too great an angle.

WM. V. LOWE.

The Automatic Versus the Hand Turret Lathe.

I am pleased to see that at page 330 a contributor agrees with me that the automatic turret lathe is not suitable for finishing all kinds of turret work. He remarks that I show no method of removing the finished work from the plug, so I send a sketch showing our method. The sketch shows the spindle nose of the turret lathe with a finished piece of work on the plug.



KNOCK-OFF FOR TURRET LATHE WORK.

A is the collar which protects the thread on the spindle and also serves as a stop. *B* is the knock-off ring, and *C* is the knock-off in position to remove the work, the operator striking it at *C* with a hammer. The knock-off ring is flatted to allow the work to touch the gage when driving it onto the plug. PAUL WESLEY.

The claim has been made that by using oak and other fine woods in the form of veneer the figure or grain shows up better than when the wood is used in regular lumber form. This leaves too much room for misunderstandings. It is foolish to state that the figure will show up better in a thin piece of veneer than it will on an inch board of the same character. But, on the other hand, we can, in making a column, for example, by using veneer, get the fine figure all the way around, while if it were made from a solid piece it would only show on two sides. In other words, we don't get a better figure in veneer, but we can make a better display with it.—*The Woodworker.*

Meeting of the National Tool Builders' Association in Washington.

The semi-annual meeting of this association was held April 11 and 12 at the Arlington Hotel, Washington. A little over one half of the total membership was represented at the meeting, East and West being represented in about equal numbers. Only one formal address was on the program; this was presented at the Tuesday morning session by W. P. Davis, of Rochester, who spoke as follows:

CONDITIONS OF TRADE.

The subject given me has such a wide range that there is no trouble to use the time allowed to speak of matters of vital interest to us all.

At our meeting in New York, November 11, 1903, we considered the subject of "How Shall We Improve Trade." Nearly two years have passed since that date, and if anyone will take the time to look up the remarks made by the various members at the meeting, he will find they have been verified by the conditions and results. It was thought at that time by all familiar with the conditions that we must find a market for our machines outside of our own country, and we would have to work hard to hold trade we had secured abroad.

It is conceded that our machine tools are more accurate and convenient to operate than those made in Europe, and especially so in the small machines as lathes, drills and milling machines; but our foreign cousins are not slow to copy and manufacture machines that are most popular of American build, and the advantage they have in the saving of transportation and duty is a serious problem.

We have found a marked change in the orders received in the past year. The demand for large tools is comparatively light, while there is a fair call for the medium size and small machines, as follows: Engine lathes from 10-inch to 18-inch swing; drills from 12-inch to 25-inch swing; shapers from 10-inch to 20-inch stroke; planers from 16x16 inches to 30x30 inches. And there is an excellent demand for new special machine tools that will produce better work and lower the cost of production.

Machine tool builders throughout the country that are making a good class of tools and are well known have been well supplied with orders.

Nearly all of the dealers claim to have had nearly the same volume of business in 1904 as in the preceding year, but the sales were made on a closer margin of profit, which was largely due to the fact that they were unloading a large surplus stock that they had been carrying. Our European trade for the past year has remained about the same as in 1903, except for the large orders placed by Japan.

If we expect to get a reduction on the duties charged in any of the European countries we must expect to be more liberal in our own policy with them, as in

some cases the duty imposed by the United States on machines shipped here is so unreasonable as to bring about retaliation on their part as in the case of Russia, where the duty is so high that it practically excludes us from the sale of our products, while our German friends are so favored that they step in and take the trade, a large part of which would come to us were it not for the prohibitive tariff on our machines.

Many seem to think that were the present war to close we would not get the trade we have been securing, but in this we believe they are mistaken. When once this war is settled there is bound to follow many years of prosperity never experienced in either country. They cannot produce the machinery, as well as the material, they will require, and if we put ourselves in a position to secure our share of the business we will secure a trade that will more than exceed our most sanguine expectations.

Wars, like failures in business, are hard and cruel teachers, but they often open up avenues that lead to great success and bring to notice possibilities previously overlooked, yet within easy reach. Our aim must be to secure foreign business, as our home market cannot use the amount of machinery we can produce. Russia and Japan are markets we need, and every obstacle must be removed to enable us to get our share of business in these two countries. While there may be a difference of opinion among Americans as to which of the two nations is in the right, all would be pleased to learn the war was over and peace had been restored.

Some may ask, what have we accomplished as an association? I will answer by saying that we have accomplished many things and will mention as one the position we took at our meeting November 11, 1903, in regard to maintaining the prices and curtailing production.

The strong position we took at that time had much to do with the tiding over a serious situation, which was not only a great help to the machine-tool builders but to many other manufacturers of machinery. The firm and decided stand we took was published by all the trade journals throughout the country and was read with interest by the public and favorably commented on by the press; and we know it was heartily endorsed by the machinery dealers. The result obtained by this one meeting has paid us well, and this is but one of the many results I could mention since the forming of the association.

All of the members are no doubt aware the supply and machinery dealers have formed an association known as the National Supply and Machinery Dealers' Association, the first meeting being called at Cleveland, February 15, 1905. Nearly two hundred members have come into this association. A large part of this number handled our goods and we all feel pleased to know of this organization which already contains many of the most progressive dealers in machinery and supplies. Much good must follow in securing understanding between these members. No one can estimate the value of the information secured thru meeting members of such an organization.

The fact that they have such a strong organization should give us an incentive to increase our own membership that we may be better able to work to the mutual advantage of both organizations.

In conclusion I will say I hope to see more enthusiasm shown among the builders of machine tools until we can number every machine tool builder as a member. And I shall be pleased to see the time when the National Machine Tool Builders' Association and the National Supply and Machinery Dealers' Association will hold their meetings the same date and in the same place, as no one can estimate the value of a personal meeting between the two associations.

Our own association has done well, but not all we could wish. We must stand together and work for the one purpose and that is to better the conditions of the machine-tool builders and in so doing we will better the conditions of trade.

TOPICS OF DISCUSSION.

After the address and the discussion that followed there was further discussion on the subject of "Advantages of the Motor Drive, and Greater Power Necessary in the Belt Drive for Machine Tools," which topic was brought up at the previous meeting of the association. This was taken up in connection with the question of "Standardization of Motor Drives" and the work of the committee appointed at the previous convention was spoken of by Edward M. Woodward, of Worcester; various other speakers gave their experience in connection with motor drives, and the work of gathering further data on the subject will be continued by the committee who will present a report to the Executive Committee before the next meeting.

Subjects coming up for informal discussion at the afternoon session were as follows: "Foundry Work and the Advantages of an Up-to-Date Foundry for the Machine Tool Manufacturer"; "The World's Markets"; "A Revision of the Apprenticeship Question"; "A Further Revision of the Prices of Detail Parts of Machine Tools." After thorough discussion of the above subjects committees were appointed to take up further consideration of the matters coming under these heads.

Considering the subject of the world's markets, it was generally conceded that the tool builders' opportunities in foreign markets could be greatly added to if properly trained men could be kept in the foreign fields, and the establishment of schools for specially training young men to this work was suggested, the idea being to give such men a good commercial training and to teach them at least three languages to enable them to get after foreign business to the best advantage. The committee appointed to consider the matter will look up the work of other countries along this line before submitting their report.

The apprenticeship question brought out some discussion, it being generally admitted that under the changed conditions in the machine shop—due particularly to the specialization of operations—there is wide opportunity for the modification of present apprenticeship systems. Like the preceding topics of discussion this matter was left to a committee for further consideration.

The subject of prices was left in the hands of the respective standing committees on lathes, planers, shapers, millers, drills, etc.

On Tuesday evening there was a banquet at the Arlington, the evening proving a very enjoyable one to both members and guests. William Lodge acted as toastmaster, and among the guests and after-dinner speakers whose remarks were received with a great deal of interest were: F. I. Allen, Commissioner of Patents; C. H. Duell, ex-Commissioner of Patents and present Associate Justice of the Court of Appeals of the District of Columbia; D. Thew Wright, Associate Justice of the Supreme Court of the District of Columbia; W. J. Rich, Patent Examiner; and W. R. Wood, of Cincinnati.

The first subject taken up for discussion at the Wednesday morning session was "Relative Cost of Power for Belt-Driven and Motor-Driven Machine Shops," and G. H. Condict, of New York, gave an interesting talk on the topic. W. R. Wood, of Cincinnati, then talked on the subject of "Patent Laws Particularly Applicable to Machine-Tool Builders," and mentioned, among other things, the broader view which the Patent Office is now taking in regard to even small changes in machine construction. These speakers were listened to with the greatest attention. Then a paper by Fred. A. Geier, of Cincinnati, concerning tariff revision was read, this being, in fact, the report of the committee on tariff revision, of which Mr. Geier is chairman, and to this report was appended a table giving the tariff rates in various European countries.

REPORT OF COMMITTEE ON TARIFF REVISION.

The present tariffs of the principal European countries—Austria, Hungary, France, Germany, Italy, Russia, Spain and Sweden—have been in force ten or twelve years, all having been enacted several years before the passage of the Dingley tariff in 1897, with its increased duties on foreign imports. While the general or the maximum rates were fixed by this tariff at the same time when the tariffs were made, an opportunity was given other countries for the negotiation of special commercial treaties, in which were to be granted mutual concessions on certain

specialties. These treaties, on the average, were to run ten or twelve years, subject to termination upon one year's notice from either contracting party.

By virtue of the most-favored nation clause in the treaties, which most nations had at some time concluded with each other, it resulted that if two countries made mutual concessions in their tariffs other countries having treaties with this clause participated in the benefits of the mutual concession without the necessity of concluding a special treaty.

COUNTRY.	NATIVE TARIFF.	AMERICAN EQUIVALENT.
Spain	High, 24 pesetas per 100 kilos	$2.10 per 100 lbs.
	Low, 20 " " " "	$1.75 " " "
France	Over 1000 kilos, (1) .15 fr. per kilo	$1.32 per 100 lbs.
	(2) .10 " "	$0.88 " " "
	Over 250 kilos, (1) .20 " "	$1.75 " " "
	(2) .16 " "	$1.40 " " "
	Under 250 kilos, (1) .70 " "	$5.14 " " "
	(2) .50 " "	$4.39 " " "
Belgium	Made principally of gray iron, 2 fr. per kilo	$0.175 per 100 lbs.
	Made principally of steel, 4 fr. per kilo	$0.35 " " "
Italy	9 lire per kilo	$0.79 per 100 lbs.
United Kingdom	Free.	
Denmark	Free.	
Netherlands	Free.	
Greece	Free.	
Sweden	10 per cent. ad valorem.	
Germany	According to preponderating material:	
	a. of wood, 3 marks per 100 kilos	a. $0.325 per 100 lbs.
	b. gray iron, 3 " " " "	b. $0.325 " " "
	c. wrought iron, 5 mks. per 100 kilos	c. $1.541 " " "
	d. other metals, 8 " " " "	d. $0.865 " " "
	New Tariff:	
	Under 250 kilos, 20 marks per kilo	Under 550 lbs., $2.13 per 100.
	250– 1,000 " 12 " "	550– 2,200 " $1.275 "
	1,000– 3,000 " 8 " "	2200– 6,600 " $0 85 "
	3,000–10,000 " 6 " "	6,600–22,000 lbs., $0.64 "
	10,000 kilos up, 4 " "	22,000 lbs. up, $0 425 "
Russia	General duty, 1.70 roubles per pood	$3 64 per 100 lbs.
	Convention duty, 1.40 roubles per pood	$3 00 " " "
	Special An. duty, 2.21 roubles "	$4 73 " " "
Austria-Hungary	High, 15 florins per 100 kilos	$2.76 per 100 lbs.
	Low, 12 " " " "	$2.21 " " "
	Machines over 100 metrical cent.	Machines over 22,000 lbs.
	High, 8 50 florins per 100 kilos	$1.57 per 100 lbs.
	Low, 5.00 " " " "	$0 92 " " "
	Not otherwise provided for:	
	7.50 florins per 100 kilos	$1.30 per 100 lbs.
	New Tariff:	
	Under 200 kilos, 26 kron. per 100 kilos	$2.36 per 100 lbs.
	200– 1,000 " 24 " "	$2.18 " " "
	1,000– 2.000 " 21 " "	$1.91 " " "
	2.000– 5,000 " 19 " "	$1 73 " " "
	5,000–10,000 " 18 " "	$1 64 " " "
	Over 10,000 " 16 " "	$1.45 " " "

TABLE OF FOREIGN TARIFFS.

Under this most-favored nation clause, the United States is granted the lower rate in Austria, Hungary, Germany, Sweden and Italy.

The United Kingdom, Denmark and the Netherlands admit machine tools free from all countries.

In Spain, thru lack of commercial treaty, American goods have to pay the higher rates, a difference of 35 cents per 100 pounds.

Belgium and Italy furnish, by comparison, a striking proof of the injustice of the 45 per cent. *ad valorem* duty which the United States is levying on imports. Belgium charges only 17½ cents per 100 pounds, and Italy 79 cents per 100 pounds.

In Russia, American goods had enjoyed the rates granted the most-favored nations under the old treaty of 1832. In 1901 an extra import duty was levied upon Russian sugar to offset a bounty paid by Russia to encourage its exportation. In retaliation, Russia increased the duties on certain American manufactures, chiefly in the line of iron and steel, including machine tools, the latter under the heading "machines not specially mentioned of cast-iron, iron or steel with or without parts of other materials." This duty was an increase, not merely over what American imports had formerly paid, but over the highest duty paid by any country. The official tariff for general duty is $3.65 per 100 pounds. It then expressly states: "Goods of American origin enter at an additional 30 per cent.," which amounts to $4.73 per 100 pounds. Nor is this the worst of it. A new tariff is in preparation which mentions metal-working machinery, in which the duties will be considerably higher than those prevailing now.

In France there are two schedules, a maximum and a minimum—a consolidation of the laws of 1892 and 1895. The latter is granted to those countries only which have made reductions on French products, sufficient to compensate for the granting of the minimum rate. In 1898 Mr. Kasson negotiated a reciprocity treaty which provided for the admission of machine tools and a large number of other manufactured goods at the minimum rate. This treaty was defeated in the Senate by the hosiery and jewelry manufacturers, who argued that the concessions demanded by the French manufacturers on their goods would be too great to effect adequate protection to American manufacturers. Even if passed, the treaty provided for no special reduction, but would simply have placed American goods on the same basis as those imported from Germany and England, an average saving, however, to American manufacturers of 44 cents per 100 pounds on light machines and 35 cents per 100 pounds on heavy machines.

In Germany during the years that have elapsed since the ratification of the present tariff, the volume of manufactures has greatly increased, while at the same time the manufacturers and farmers have also had to meet keener foreign competition. This has resulted in a demand from both classes for more adequate protection against foreign nations. In response to this protest the Reichstag enacted a tariff which is to go into effect in 1906, with heavy duties on all foreign products. The tariff on machinery has been raised from 32 cents per 100 pounds to a sliding scale that diminishes as the weight increases from 550 pounds up and over 22,000 from $1.28 to 44 cents per 100 pounds.

Referring to the above rate, Mr. Schutte in a recent letter says: "If the United States does not come to some arrangement with Germany, we shall simply have to pay the rates as specified above, which, as you can well imagine, would be a great hardship to us and is certainly bound to cut down purchases for Germany to a very large extent."

As yet it is not known what concessions have been made to other countries, but heretofore the United States has enjoyed the most favored nation clause under the treaty with Prussia in 1828, and by the agreement with Germany in 1900. The latter agreement can be terminated in three months by either party, while for the Prussian treaty Germany has given the United States to understand that it is not considered binding on the Empire. The question therefore arises whether the German Government will consider products of the United States as entitled to the conventional rates of the German tariff as heretofore.

Austria-Hungary: A new tariff which

goes into effect when the tariff treaty with Germany is passed puts a rate of $1.45 per 100 pounds on machines over 1,100 tons and a tax varying from $1.64 to $2.36 per 100 pounds on lighter machines.

This higher tariff is aimed particularly at the United States, as "it was evidently the wish of all industries to revenge themselves for the higher rates which America had imposed and the current tariff made this impossible without declaring a so-called tariff war."

In our own country the Dingley tariff has worked other evil. Canada, for a time our closest friend, was estranged, and in retaliation levied a tariff of its own against the United States which includes 25 per cent. *ad valorem* duty on machine tools.

Thus we find that Russia and France have already openly shown their resentment against America by the declaration of special tariff rates, while beginning with next year Austria-Hungary and Germany will have in force a new tariff with discriminations against our country.

All of the above tariffs are so arranged that concessions can be made to any nation which duly reciprocates, and herein lies the salvation of the United States if Congress can be persuaded to move. Treaties can be made and arranged with these nations, in which, by the granting of special privileges, America will be in a position to ask for return favors, among which machine tools should have a prominent place.

The duty of our country in this crisis, which we manufacturers ought to recognize and use our influence to meet promptly, is to cease waging war against these nations with whom we desire to trade, and to enter upon some amicable treaties with them in which we shall give as good as we desire to take. We have long been at a point where it was evident that our country was not a sufficiently large field for the full expansion of our manufacturing enterprises. We want the world for our market, and we must enter that market by friendship and not by warfare. We cannot deal with Europe as we once did with Japan, compel them to open their markets to us, but we can offer to buy what they have to sell and thus persuade them in turn to deal with us.

And it may not be improper to suggest, in this connection, that the efforts which we are to put forth in behalf of more sympathetic trade relations with our foreign rivals will be more hopeful of moving the hearts of our national legislatures if, in the agitation for a modification of existing tariff rates, we make common cause with other bodies of American producers whose interests, like our own, are gravely threatened. It is not machinery alone against which the foreign tariffs are arrayed; it is against a hundred other American products, and the time has come when, as in the famous words of Benjamin Franklin, when the Declaration of Independence was about to be signed on the Fourth of July, 1776: "We must all hang together or assuredly we shall all hang separately."

After the reading of the above report it was decided to hold the next meeting in New York at a date to be settled later, and the convention then adjourned.

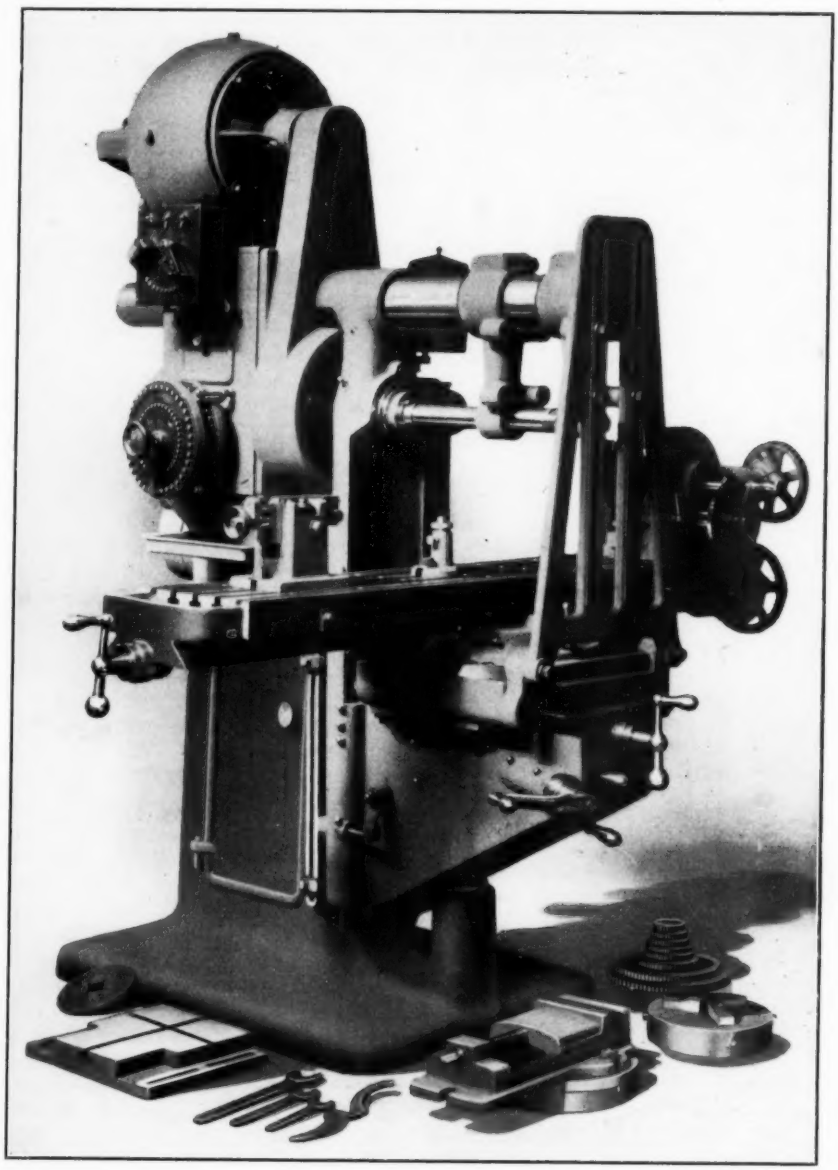
In the afternoon a visit was made to the War Department, where the party met Secretary Taft, and later an automobile trip was taken about the city.

MEMBERSHIP.

There are now forty-five tool-building concerns represented in the association, two new ones having been elected during the convention. These latter are the Bullard Machine Tool Company and the Bridgeport Foundry Company.

REGISTER OF MEMBERS.

William Lodge, representing Lodge & Shipley Machine Tool Company, Cincinnati; L. W. Anderson, Cincinnati Shaper Co., Cincinnati; F. W. Boye, Jr., Schumacher & Boye, Cincinnati; B. B. Quillan, Cincinnati Planer Company, Cincinnati; Chas. S. Gingrich, Cincinnati Milling Machine Company, Cincinnati; H. L. Flather, Flather & Co., Inc., Nashua, N. H.; Geo. O. Gridley, Windsor Machine Company, Windsor, Vt.; Fred L. Eberhardt, Gould & Eberhardt, Newark, N. J.; C. H. Alvord, Hendey Machine Company, Torrington, Conn.; Murray Shipley, Dietz Machine Tool Company, Cincinnati; E. M. Woodward, Woodward & Powell Planer Company, Worcester; P. E. Montanus, Springfield Machine Tool Company, Springfield, Ohio; Enoch Earle, P. Blaisdell & Co., Worcester; W. P. Davis, W. P. Davis Machine Company, Rochester; V. F. Prentice, Prentice Bros. Company, Worcester; J. W. Carrel, Draper Machine Tool Company, Worcester; W. A. Wilson, W. A. Wilson, Rochester; O. M. Flather, Mark Flather Planer Company, Nashua; J. S. Detrick, Detrick & Harvey Machine Company, Baltimore; H. Hoeffinghoff,



MOTOR-DRIVEN MILLING MACHINE.

Bickford Drill & Tool Company, Cincinnati; R. K. LeBlond, R. K. LeBlond Machine Tool Company, Cincinnati; E. P. Bullard, Jr., Bullard Machine Tool Company, Bridgeport, Conn.; J. B. Doan, American Tool Works Company, Cincinnati; C. J. Wetsel, Baush Machine Tool Company, Springfield, Mass.

BUSINESS CONDITIONS.

Everybody present at the convention seemed to be having an enjoyable time; and everyone spoken to on the subject of business stated that business was exceedingly good, and several reported they were obliged to run their shops overtime.

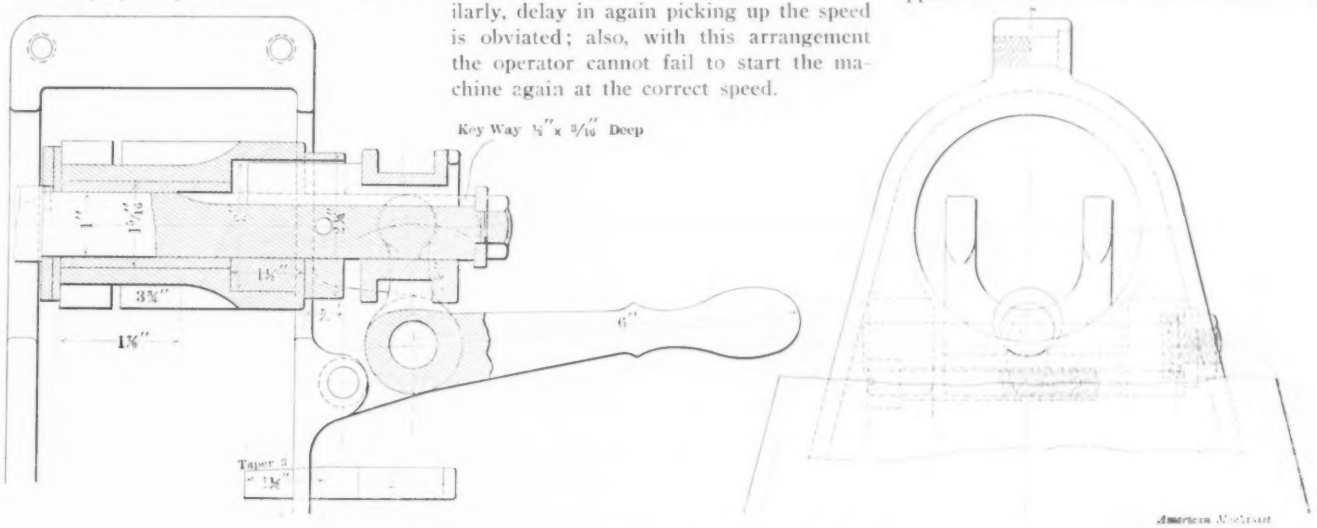
During the convention members and visitors had the opportunity to witness the operation of one of the Electro-Dynamic Company's variable speed motors temporarily installed at the hotel.

Tantalium for Tools.

Tantalium, the metal that has lately been employed by Siemens & Halske for incandescent lamp filaments, and may for that purpose be destined to a great future, is said to possess remarkable possibilities as a material for tools. *Kraft* quotes N. von Bolton, a chemist, to the effect that it has been shown by laboratory experiments to possess a hardness comparable with that of the diamond and is also very tough. When after much work a piece of the pure metal was for the first time produced a sheet about 1 millimeter (.039 inch) thick was hammered from it. An attempt was made to drill this and, other means failing, a diamond drill was used. Constant work for three days and nights at the rate of 5,000 revolutions a minute resulted in a depth of only ¼ millimeter and the drill was so badly worn that the experiment was discontinued. Since tantalium is thoroughly unmagnetic it would be of use where a metal as strong as steel is needed but where the magnetic properties of the latter are objectionable. The fusing point lies about 2,300 degrees Cent., its specific gravity is 14 to 17; and in color it resembles platinum. In the form of wire it sustains a load of more than 90 kilograms per square millimeter, or 128,000 pounds per square inch.

Motor-Driven Milling Machine.

This universal miller is shown equipped with a variable speed motor having a speed range of about 3 to 1, and three mechanical speed changes are possible thru a quill on the spindle which takes the drive from the motor shaft, this quill being equipped with double friction back gears and also being so arranged as to be clamped direct to the spindle face gear when the back gears are disengaged. The drive is by a Morse chain from a friction pinion on the motor shaft so that the frequent operations of starting and stopping the spindle to examine and test work or for other purposes, are entirely mechanical and are performed without interference with the electrical appliances at all; thus any delay in stopping due to the rapidly running motor is avoided and, similarly, delay in again picking up the speed is obviated; also, with this arrangement the operator cannot fail to start the machine again at the correct speed.



FRICTION DRIVE FOR SPINDLE OF MILLING MACHINE.

The three mechanical changes obtained are in exact geometric progression, the interval being covered by the speed range of the motor. In this manner a complete range of spindle speeds is secured in geometric progression, with an average increase of not more than 3 per cent. In other words, with the motor speed range of 3 to 1, the minimum speed being 400 and the maximum 1,200, a machine spindle speed of 100 to 300 turns per minute is obtained by connecting the face gear direct to the sleeve; a speed of 32 to 96 using the back gear, and a speed of 10 to 30 using the second back gear, thus giving a range of spindle speeds from 10 to 300 turns per minute. The back-gear speeds are obtained with the regular friction back gear and can be changed while the machine is in motion. The spindle can also be stopped when the machine is in operation thru the back-gear friction. This gives two-thirds of the entire range of speeds without stopping the machine. The motor housing and entire connection is so made that it can be applied to any of the regular milling machines built by the company.

The line cut shows the style of friction used. It is applied direct to the shaft of the motor and is controlled entirely by the operating lever and its taper shoe, the force applied to the shifting lever therefore increasing or decreasing the power of the friction as desired.

The R. K. LeBlond Machine Tool Company, 4620 Eastern avenue, Cincinnati, Ohio, is the maker.

Monthly Meeting of the A. S. M. E.

The last monthly meeting for the season of the American Society of Mechanical Engineers in New York will be held on Tuesday evening, April 25. Gus. C. Henning will discourse upon diamonds, what they are, their properties, the methods of working them, both those used in manufacturing operations and the brilliants or jewels. The lecture will be illustrated not only with lantern slides but with special apparatus. Ladies are invited and expected and special arrangements will be made for their entertainment.

The date of the Scranton meeting of the society will be June 6 to 9.

Making Drawings that will Not be Misunderstood—Erratum.

Thru an error in the engraving, the cuts with the article at page 497, by S. A. Moss, do not show what they were intended to, and practically nullify that part of the letter which refers to them; in the side views in Figs. 1 and 3 the line representing the under side of the square head of the bolt should *not* pass across the rectangular body, as this body from the end view is obviously of the same width as the head. The error in the engraving should have been detected in looking over the proof and ordinarily would have been, but in this case it slipped thru. We cannot blame the engraver because the sketches he had to work from were not very distinct. Distinct sketches are much to be preferred.

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Artists' Representations of Mechanical Subjects.

A newspaper writer, who evidently knows a good deal about ships and yachts, etc., pokes fun at a picture published in one of the illustrated weeklies because it shows Secretary Hay as the "man at the wheel," the wheel (of the old-fashioned sort) being, by the artist, taken out of its usual location and placed upon the bridge of the ship of state, where of course it never is placed in a real ship.

To one who is more or less familiar with mechanical affairs, the representations of such things by artists are an almost constant source of annoyance. It sometimes seems as tho artists go out of their way to have such things wrong—get them wrong when it would apparently be somewhat easier to have them right. In a recent number of one of the best literary magazines the heroine of a story is shown on the engineer's seat in the cab of a locomotive. Her hand is on the throttle and she is "guiding the iron horse as he annihilates distance." Her hair streams out behind in a long, straight line and the artist has evidently taken every means known to him of conveying the impression of high speed ahead. But the reverse lever is one of the most prominent features of the illustration and it is near the "back corner," so that everyone who looks at the picture and who knows anything of locomotives knows that the engine is backing up, that the girl's hair ought to be streaming the other way, and that instead of gazing intently forward she should be leaning out of the side window or looking back, over the tank.

A good artist employed to illustrate furniture sale advertisements in the metropolitan dailies showed a sawmill in operation and had its circular saw throwing sawdust *up into the air* above the log. The same artist had woodsmen cutting down trees, and the stumps, instead of being in the form in which woodsmen the world over always leave them, looked as tho the trees had been gnawed down by beavers.

In Newark, N. J., there is a monument to Seth Boyden, the pioneer locomotive builder and inventor of malleable castings. A bronze plate on the base of the monument, which plate has been pryed off and stolen, showed a locomotive in bas-relief and the side rod was connected above the axle on one wheel and below the axle on the other.

At the Pan-American Exposition there was a really beautiful group of statuary representing the blacksmith. This blacksmith had a drill press as country blacksmiths usually do, but its arrangement of parts, and especially of gearing, was utterly meaningless and inane. The blacksmith himself was holding upon the anvil a piece of iron. He was using no tongs, tho the piece was short and heavy. If supposed to be hot he could not so hold it for a second, and in any event when the helper's uplifted sledge descends upon it, the blacksmith's arm will be broken or the piece knocked out of his hand. In other words, he is holding the work in a manner in which no real blacksmith ever held such a piece of work or could hold it.

In the British Museum there is said to be a famous painting representing the striking of a medal to commemorate an important historical event. A screw press is being used and the man is straining upon the lever with all his strength to bring the die down and make the impression. But the threads of the screw are left-handed and therefore the strength of the man is being exerted to produce a result just the opposite to what the artist intended.

A more humble artist showed a micrometer caliper being handled as a roller would handle his gage in gaging a hot bar—in a manner in which no man ever did or ever could actually use a micrometer.

Instances might be multiplied almost indefinitely in which artists have seemed to be absolutely indifferent to technical truth in the representation of mechanical subjects. If they needed to become mechanicians in order to be correct in such things there would be more excuse for them, but they need not. They need only to draw from life, so to speak. In other words, they need only to look at the thing they purpose to represent and draw it as it is, and it seems as tho those of us who happen to know something of mechanical matters are becoming sufficiently numerous and sufficiently appreciative of art to have our feelings respected to that extent. An artist's work may have all the artistic merit he may be capable of getting into it and indeed may have very much of that without being technically correct. But it may also be technically correct, and in being so be the better.

The Cheapness of Human Life.

A press report published in one of the most reliable daily papers is to the effect that the carelessness regarding human life has become so great in some of the large Pittsburg steel mills that the Austro-Hungarian Consul-General has been compelled to take cognizance of the matter; his interest in it arising from the fact that a large proportion of the men whose lives are sacrificed are Hungarians. It is stated that the means provided for protecting these men from fatal accidents are shamefully inadequate; that the laws relating to such matters are practically ignored and that men whose personal effects are found at certain places in the mills, indicating that the men have stumbled and fallen into furnaces while at work, are simply reported as missing, and other men hired to take their places, the coroner and other officials ignoring the whole thing. We hope for the sake of the credit of human nature that the report is untrue, or at least exaggerated, but it certainly ought to be

sifted. The condition in which some men's minds can be regarding such matters is shown by the experience of a certain acquaintance of ours who invented a device to prevent girls and boys from getting fingers cut off in punch-presses. The head of a certain large packing establishment in Chicago was approached for permission to try the device on one or more of the presses used in his factory for making tin cans. Upon the cost of the appliance being mentioned to him he said, "Hell, fingers don't cost us anything."

Rear Admiral Melville on Naval Affairs.

The views of Rear-Admiral Geo. W. Melville, retired, upon all things which relate to the navy have always commanded and will always command attention and receive careful consideration. It is for this reason that the views expressed by him recently before the American Academy of Political and Social Science in Philadelphia are being commented upon by the press far and wide, and it is evident that they are making a decided impression. In substance, the admiral stated that the naval operations of the Russo-Japanese war showed that our energies should be directed toward the development of auxiliaries of naval equipment, and not toward increasing the number of fighting ships. He expressed belief that the bulk of our expenditures, for a time at least, in the Navy Department should be: first for the preparation of plans for the immediate abandonment of every distant possession that is likely to require a fleet to defend it. On this point we think there is little room for difference of opinion among those who have given the matter careful consideration. It is true that there are some Americans who always insist that America is big enough and strong enough to do anything, and that the distant possessions that we have in one way or another acquired should be held on to at all odds. The question of whether they should be held or not is of course twofold: first, it is a political question; and next, it is a strategical question, which last is the aspect in which Admiral Melville considered it. From this viewpoint it is evident that the admiral believes our outlying possessions should be as quickly as possible abandoned. This on the ground that, should any difficulty arise with a foreign nation, it would be practically impossible for us to defend these distant possessions unless we had a navy which, in times of peace as well as in times of war, would be frightfully expensive and a tremendous burden upon our industrial and productive capacity. Admiral Melville also advocates the improvement of channels leading to all ship-building plants, so that these might be used with greater facility and for larger vessels in time of war. He believes also that we should build a fleet of large and fast colliers which might be depended upon to keep naval vessels supplied with coal in time of war, and he evidently believes such vessels would be more efficient for this work than coaling depots, which he says would require not only forts but naval vessels to defend them, and that they would therefore be an element of weakness rather than of strength. Naturally, Admiral Melville still sticks to his position regarding the essentially engineering character of modern naval operations, and insists upon it that the training of engineer officers should be more technical in character. In this connection, he said that the time spent by apprentices and landsmen in sailing vessels is practically wasted. This, it would seem, would be obvious to almost anyone who considered the nature of present naval construction and the methods of handling naval vessels. The equipment of a navy is machinery from end to end. The construction, handling and use of this machinery is all technical in a high degree. No one who can open his eyes to this fact and can consider it from an unbiassed standpoint, can possibly decide otherwise than as Admiral Melville has decided; that is to say, that the men who are to either design, construct or handle this naval machinery are wasting their time when they are being taught how to handle old-style, obsolete sailing vessels.

A Spring Motor.

It is just possible that an editor with a big blue pencil is needed in the publication department of the Department of Commerce and Labor wherein the daily consular reports are issued. This possibility is suggested by a report we find in a recent issue from James H. Worman, our consul at Three Rivers, Quebec, describing a universal spring motor. Mr. Worman gives the name of the company making this spring motor, states its capitalization, and that the spring motor is something which is operated by a "stout spring which can be wound up by hand," and which, when "once wound up, will work for a long time without further attention," and will drive household sewing machines entirely independent of electric wires or other attachments.

Now, of course, anyone familiar with mechanical matters knows what perhaps Mr. Worman is not familiar with, and that is that there have been spring motors without number that have been invented and that have fallen into "innocuous desuetude," mainly because in the nature of the case there is little hope that a spring motor, applied to such a purpose, can be of very great utility. Spring motors do very well to drive clocks and to do other work requiring very light development of power, but where any considerable amount of power is to be used the task of winding the spring is found to be rather strenuous, and as no motor has been or can be made which will return all the energy that is put into it, there is a loss, which loss is of course avoided by applying one's muscular energy directly to the machine to be driven.

While it is within the bounds of possibility, perhaps, that this new spring motor embodies features not heretofore thought of in connection with such motors, and that it is an invention of sufficient importance to be thus freely advertised in a United States Government publication, we very seriously doubt it, and do not believe that such things should be admitted to the columns of a Government publication without a very careful scrutiny by competent and disinterested persons.

New Publications.

"Steam Turbines." By A. Stodola. Translated from the German by Louis C. Loewenstein. 434 6x9-inch pages with 241 illustrations. D. Van Nostrand Company, New York. Archibald Constable & Co., London. Price $4.50.

The translator has done a great service to American engineers in translating this great work of Dr. Stodola into English. It contains, without doubt, the most complete analysis and the finest collection of experimental data upon the steam turbine which have yet been recorded. The observance of scientific principles is especially important in steam turbine design if success is to be obtained. The book is divided into three parts, the first of which discusses the principles peculiar to turbines, while the second takes up investigations of a more advanced mathematical character, and the third is greatly amplified and gives a short *résumé* of the mechanics of heat. For the benefit of the engineer whose thermodynamics has grown somewhat rusty, the fundamental laws of the science have been briefly derived for heat motors. An appendix discusses the future of the heat engine. It must not be understood that the book is a theoretical study of the heat transformations taking place in turbines only, for, on the contrary, it discusses at length the construction of the most important turbine parts, including of course the stresses in revolving disks at high speeds. A section of over 100 pages in length is given to a discussion of the peculiarities of construction and action of the leading types of turbines which have already been built. The formulas of the original German edition were of course in metric units, but in the translation these are given in both English and metric units. Experiments by the author and other European engineers and scientists are left in their original units, but all important results from these experiments have been recalculated for the English system. The translator has also prepared a large entropy diagram in English units which appears as a folded plate inserted in a pocket in the cover, together with the original diagrams by the author in metric units. The great and growing interest in the steam turbine will no doubt lead to a sub-

stantial recognition of the labors of the translator.

"The Temperature Entropy Diagram." By Chas. W. Berry. 134 4¾x7¼-inch pages with 49 illustrations. John Wiley & Sons, New York. Price $1.25.

This book may be described as a manual of the use of the temperature entropy diagram intended for those who are already familiar with the theory of thermodynamics. It collects together, in logical order, certain information concerning the construction, interpretation and application to engineering problems of the temperature entropy diagram, which information is scattered throughout various treatises. The book is scarcely readable by those who do not have a fair knowledge of the subject, and thus, while dealing chiefly with applications, cannot be called an elementary book. It will be found especially useful by those whose knowledge of the subject is a little rusty and who desire to familiarize themselves with its applications without laboriously recovering the entire study of the subject.

"Experimental Researches on the Flow of Steam Thru Nozzles and Orifices." By A. Rateau. Translated from the French by H. B. Brydon. 76 5x7½-inch pages, with 3 text cuts and 4 folding plates. The D. Van Nostrand Company, New York. Price $1.50.

The experiments which are recorded in this volume were made when the author was beginning the studies which have resulted in the steam turbine which goes by his name, and their publication is a distinctly public-spirited act. They relate to the fundamental problem of steam turbine design—the proportions of the nozzles and passages—and, while made with the care and precision of scientific research, are coupled with a keen appreciation of practical constructions. The importance of the book to those engaged in steam turbine design is out of all proportion to its size.

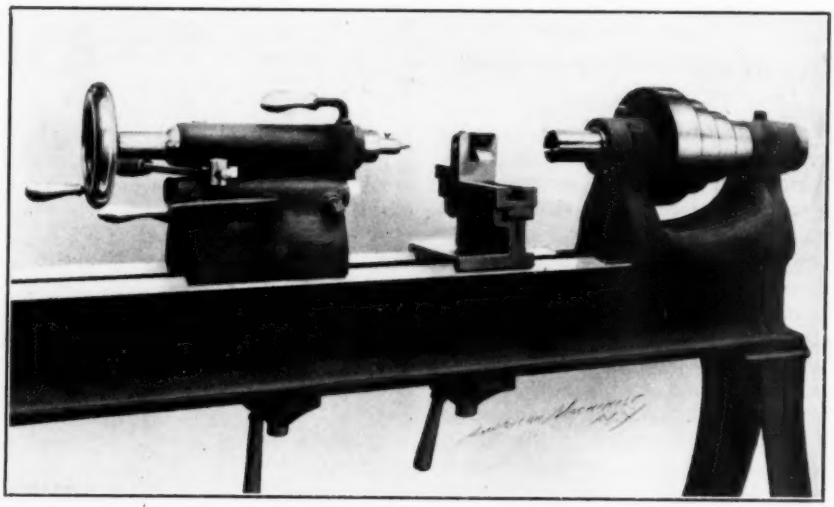
"Mechanism." By S. Dunkerley. 408 5½ x8½-inch pages with 416 illustrations. Longmans, Green & Co., London, New York and Bombay. Price $3.00.

This treatise is founded, as are all modern treatises upon this subject, upon the Reuleaux analysis. It is not mathematical and is self-contained, so that it is readable by anyone who will make the necessary effort to read it. A large number of illustrations of the uses of the various mechanisms are given in order that their kinematic significance may be made plain. A good deal of attention is given to velocity and acceleration diagrams, of which the former, by simple inversion, become force diagrams, and this analysis is of large use in connection with the transmission of movements or of forces thru link work. The whole forms an exceedingly satisfactory treatise upon the subject.

New Tools and Machine Shop Appliances.

A CENTERING MACHINE.

It is claimed for this machine that the work can be done quicker and more accurately than in any other way, and that finished work can be centered so that it does not require to be turned afterward to make the article perfectly true, and altho producing such accurate work it is done so rapidly that an unskilled boy can center both ends of from 2,000 to 3,000 pieces per day. The centering is done by a combined drill and countersink. The piece to be centered is held by the hand against the fork rest. The combined drill and countersink—mounted in the tail spindle—is then brought to bear against the work, forcing the end of it into the tapered driving chuck on the end of the live spindle until the work begins to rotate. It is allowed to rotate until completed, when by withdrawing the drill and countersink it is released. It will be seen from this that no time is lost in fastening or releasing the piece. In addition to this, pieces which have been centered and are not true can be by using countersink alone, made perfectly true with the outside. The maker is the Automatic Machine Company, Greenfield, Mass.



A CENTERING MACHINE.

NEW STARTING AND REGULATING RHEOSTAT.

The accompanying illustrations show two forms of a new controller for variable speed motors, which is a recent product of the Cutler-Hammer Manufacturing Company, of Milwaukee, Wis. Fig. 1 shows it as fitted with underload release only, and Fig. 2 as fitted with both underload and overload release.

As shown in Fig. 1, the apparatus is primarily a motor starter and field resistance lever, which are so arranged as to be manipulated as though there were but one. The outer lever, to which the handle is attached, is the field lever, while behind it is the starter lever, which is so arranged that moving the former to the right also carries the latter with it. When

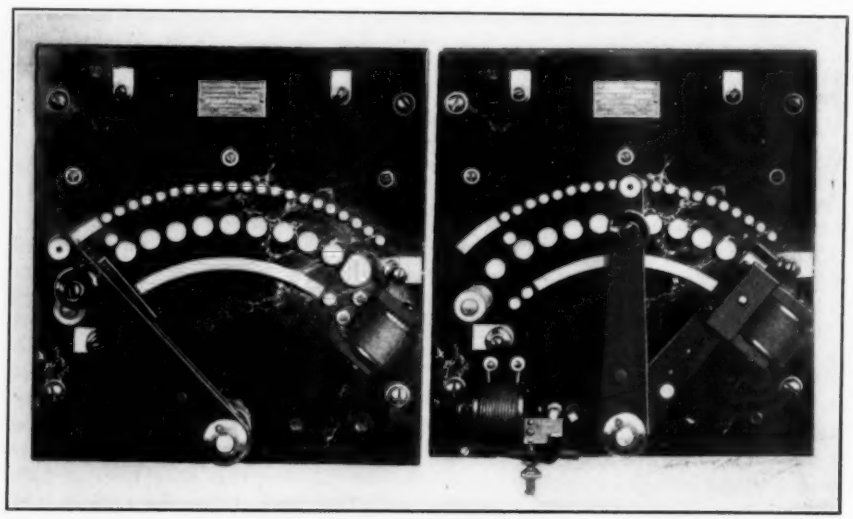


FIG. 1. UNDERLOAD RELEASE ONLY. OFF POSITION.

FIG. 2. UNDERLOAD AND OVERLOAD RELEASE. OPERATIVE POSITION.

this is done in starting a motor, the field resistance is short-circuited by an auxiliary contact on the starter lever and a curved sector below the armature contacts. As movement goes on, the starting resistance is gradually cut out of the armature circuit, and as it is completed all resistance is cut out of the armature circuit, the short circuit is removed from the field resistance, and a keeper on the starter lever is attracted and held by the retaining magnet at the right; but the field lever is at liberty to be thrown to the left to any point necessary to weaken the field, and thus give the speed required. Should, however, the retaining magnet be de-energized by failure of the current, the starter lever is released and returns to the starting position, carrying with it the field lever. It will be observed that not only is the breaking of the circuit insured on failure of the current, but that starting the motor with a weakened field is impossible.

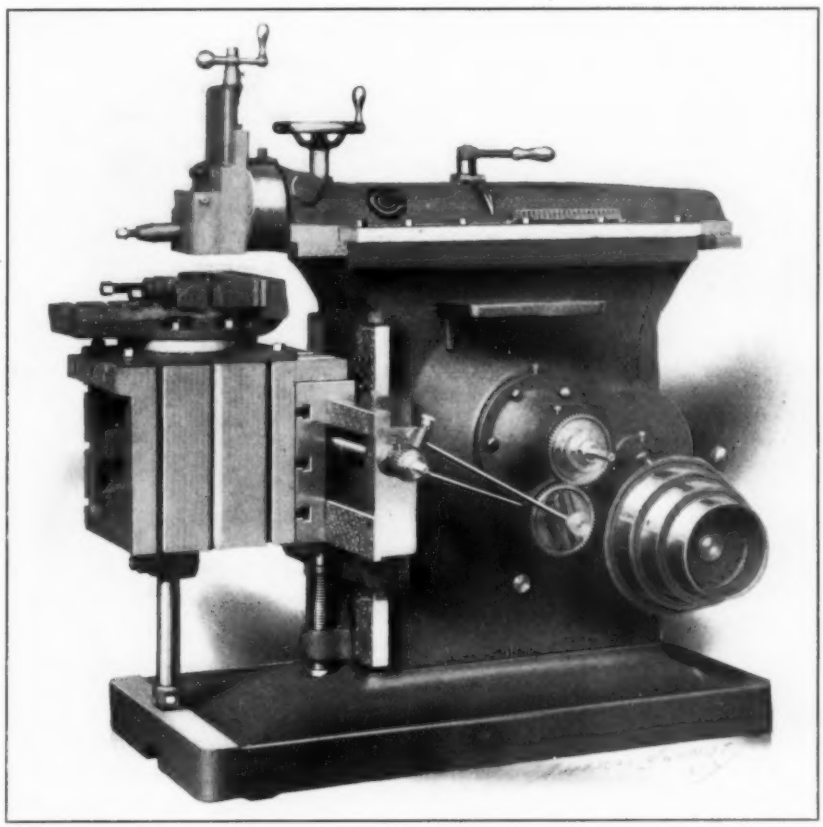
The overload-release magnet shown in the lower left-hand corner of Fig. 2 acts, in the case of an abnormal current, to short-circuit the underload-release magnet, and thus release the starter lever precisely as in the case of an interruption of the current.

MILLING MACHINE VISE.

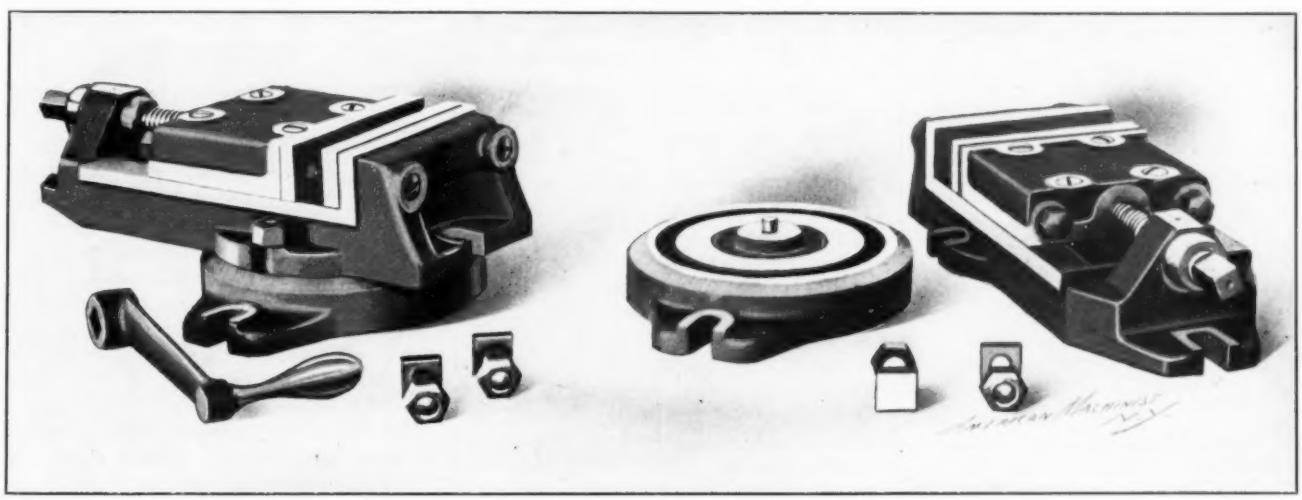
To derive the full benefit from high-speed milling cutters it is of course essential that the work be so held that there shall be no possibility of vibration under fast cuts. With this end in view, the makers of the vise shown in the accompanying half-tone have provided it with a heavily ribbed base and with stiffly supported jaws to grip the nut firmly and without liability of its springing under the cut. The vise is made with jaws from 5 to 8 inches wide, and is equipped when so required with a circular graduated base, which is attached with two bolts, so that it may be used either as a plain flat vise or as an adjustable swivelling one. All parts of the vise are constructed on the interchangeable plan. The maker is the Becker-Brainard Milling Machine Company, Hyde Park, Mass.

A NEW "HIGH-DUTY" SHAPER.

The half-tone shows a new high-duty back-geared crank shaper. This is designed to be the most powerful shaper of its stroke on the market and should come near to satisfying the modern demands for high speeds and heavy cuts. The main casting of the machine is of unusual width and depth and is heavily ribbed and braced internally, the projections at the front and back giving a very long bearing for the ram, which has also ample width of wearing surface. The head swivels to any angle and is graduated. Collars on the down feed screw and on the traverse screw of the cross-rail are graduated to read to .001 inch. Full length taper gibs are used throughout. The machine may be used either single or back geared, the ratio in the former case being 6 to 1, and in the latter 24 to 1. The four speeds thus give eight numbers of strokes per minute, as follows: 8.2, 11.6, 16.2, 22.9, 32.8, 46.5, 65, 91.9. The front strip of the base is accurately parallel with the cross-slide to make the front support properly available. Ball bearings are provided under the elevating screw, which is telescopic, so that it never



A NEW HIGH DUTY SHAPER.

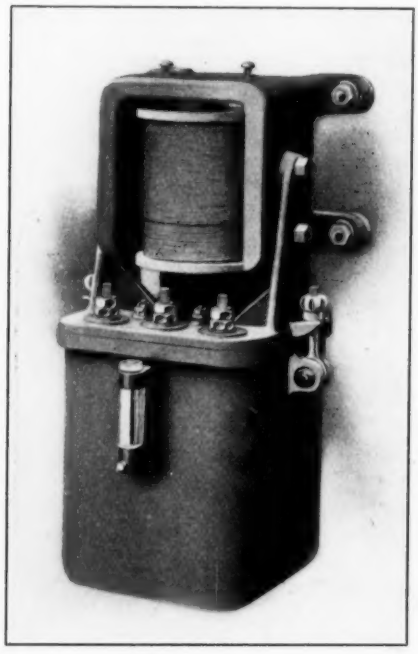


MILLING MACHINE VISE.

projects below the floor. The cross feed connecting rod is automatically adjustable for any hight of the rail, and is not dependent upon frictional contact. Key-seating or other work upon long shafts up to 3½ inches diameter is provided for by an opening running thru under the ram. The length of stroke is changed from the working side of the machine and the fore-and-aft position of the ram by means of the hand-wheel on top, either while the machine is running or at rest. The following are a few of the dimensions: Extreme length of stroke, 21 inches; vertical travel of table, 14⅝ inches; horizontal travel of table, 22 inches; top of table, 20x13 inches; length of ram bearing, 33 inches; width of ram bearing, 11 inches; range of feeds, .016 to .100 inch; vise jaws, 12x2¼ inches; vise opens 10 inches; floor space, 7 feet 11 inches by 4 feet 4 inches; weight of machine and countershaft, 3,400 pounds. It is built by the Cincinnati Shaper Company.

SOLENOID-OPERATED OIL SWITCH.

The accompanying illustration shows a solenoid-operated oil switch, designed for three-phase current of 100 amperes or less. The solenoid is operated by a push-button or small snap switch, which can be operated at any convenient point, the main switch being, of course, on the main line. It is intended for control-speed motors of small horse-power, and is made by the

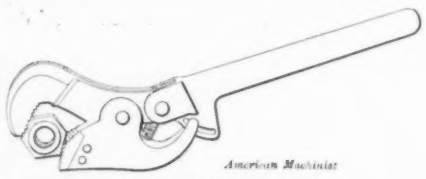


SOLENOID OPERATED OIL SWITCH.

American Electric and Controller Company, of 12 Dey street, New York.

AN AUTOMATIC WRENCH.

The illustrations show a wrench which seems to be the acme of handiness besides possessing the other desirable qualities of a universal wrench. It automatically grips anything, nuts, bolt heads, round rods, pipes, the thumb of the operator being used only to draw back the jaw; the spring brings the jaw to clasp the work snugly and then the lever locks it. The reversal



BULLARD AUTOMATIC WRENCH.

of the lever at once releases the jaw. The wrench is well made of drop-forged steel, the jaws being of high grade tool steel. It is known as the Bullard automatic

BULLARD AUTOMATIC WRENCH.

wrench and is made by the Bullard Automatic Wrench Company, Providence, R. I.

FRENCH WELDING PLATES.

The Lafitte welding plate, which has been very successfully used in Europe for some time and which is now being introduced into the United States, seems to quite satisfactorily fill a long and actually felt want of the blacksmith. In the operation of welding, a section of this plate is laid in the joint between the portions to be welded, with the result that perfect welds are effected at a low heat between metals which it has heretofore been difficult or impossible to weld. The plate can be broken by hand to any desired size without loss. Whether welding iron to iron, steel to steel or steel to iron, the union of the metals is always absolutely perfect.

Large machinists in Philadelphia, like Bement, Miles & Co., Camden Iron Works, etc., find that they can weld crucible steel with comparative ease by the use of these plates, thus renewing tools, joining short pieces, putting shanks on short drills, etc. While the material is invaluable for welding of all sorts, its greatest value to the shops is in welding hard steel, jumping steel on iron, welding together steel rings, repairing steel castings, etc. The material produces a chemical action which evidently dissolves the skin of the iron and steel with which it is placed in contact and brings together the actual fibers of the metal lying below the surface, the result being not a weld but apparently a solid piece.

In several of the shops in Philadelphia they have welded pieces together and endeavored to force them apart while hot, and the material has invariably split or broken at some point other than the weld. In scientific tests which have been made, in many cases both the tensile strength and the elongation have been increased rather than diminished. This depends largely upon the material employed. F. R. Phillips & Sons Company, Philadelphia, are the American agents for the Lafitte welding plate.

Retirement of G. A. Gray.

The many friends of George A. Gray, of Cincinnati, will be interested to learn that he has practically retired from active supervision of the affairs of the company which he has built up and of which he has been president so many years. Tho it would be quite possible for Mr. Gray to remain "in the harness" perhaps for many years yet he has thought it best to indulge himself in a little leisure, and he writes us expressing the utmost confidence in the ability of the younger men, Messrs. Zuest, Erdeman and Marx, who have been identified with him and who will now carry on the business. The foundry which has been a separate corporation, tho making castings exclusively for the G. A. Gray Company, has now been absorbed by that company and some improvements and extensions are, we understand, in contemplation, tho there will be no radical departure from the policy of the company as pursued under the active leadership of Mr. Gray, who has been prominently and creditably identified with American machine-tool building industries for many years.

The advertising representatives of a large number of concerns engaged in the manufacture of machinery and allied industries have formed an organization to be known as the Technical Publicity Association. The first annual meeting, dinner and election of officers will be held in the rooms of the Hardware Club in the Postal Telegraph Building, New York city, on the evening of April 27, when an address will be delivered by E. P. Harris, well known as a broker of trade and technical journals.

We have received a highly interesting circular of the Higher Technological School of Tokyo, Japan, from which we learn that the school has now in operation departments giving instruction in dyeing and weaving, ceramics, applied chemistry, mechanical engineering, electrical engineering and electro-chemistry, industrial designs and architecture. The institution also includes a school of industrial apprentices, a training school of industrial teachers and a school of supplementary industrial education. The students enrolled number nearly a thousand.

Photographic comparisons prove that the light on a bright day is 18,000 times stronger at the seashore, and 5,000 times as strong on the sunny side of a street, as in the ordinary shaded and curtained rooms of a city home.

Grinding and Grinding-Machine Rests.

One of the most important things about grinding is the manner in which the work is supported. The rests which are described and illustrated herewith are the outgrowth of several years of grinding practise and are in use at the present time. We don't claim they are perfection, but they are the best we could do, and we have never seen anything better.

DESIGN OF RESTS.

Now, our idea on the rest problem is this: Whenever there is a sufficient amount of one kind of grinding to do, have a special rest made to do it. Have the rest made in one piece, holding a certain number of shoes instead of rigging up with individual rests. We have made rests up to 20 inches long, holding eight shoes, and find this arrangement the best practise. Our reason for having the rests made in one piece is that greater stiffness is thus gained, and the whole thing in grinding is to have everything as stiff as possible.

Fig. 1 shows our standard pattern of rest. This does not cost very much to make; all the finish there is on it is on the bottom and top, on the under side of the cover and in the slots. Great care is exercised in planing the slots to get them all alike, so that the shoes will interchange. The edge *A* on the cover is to keep the water from running back over the rest. The nut *B* on the screw *C* pushes the lead shoe forward as it wears. The slot *D* in the bottom is to allow the rest to be used as a clamp rest when necessary. Four bolts hold the cover down onto the shoes very firmly; for a longer rest more bolts should be used.

We cast the shoes in gray-iron molds and get nice clean castings, requiring no finish. Half tin and half lead is the composition we use; the shoes are about 8 inches long, and are used until there is only 2 inches left. All scrap is saved and remelted. We have over a hundred varieties of these rests with different combinations of shoes. The shoes are all made in standard sizes. They are 1 inch thick, and in width run from 1 inch to 2½ inches, varying by quarters.

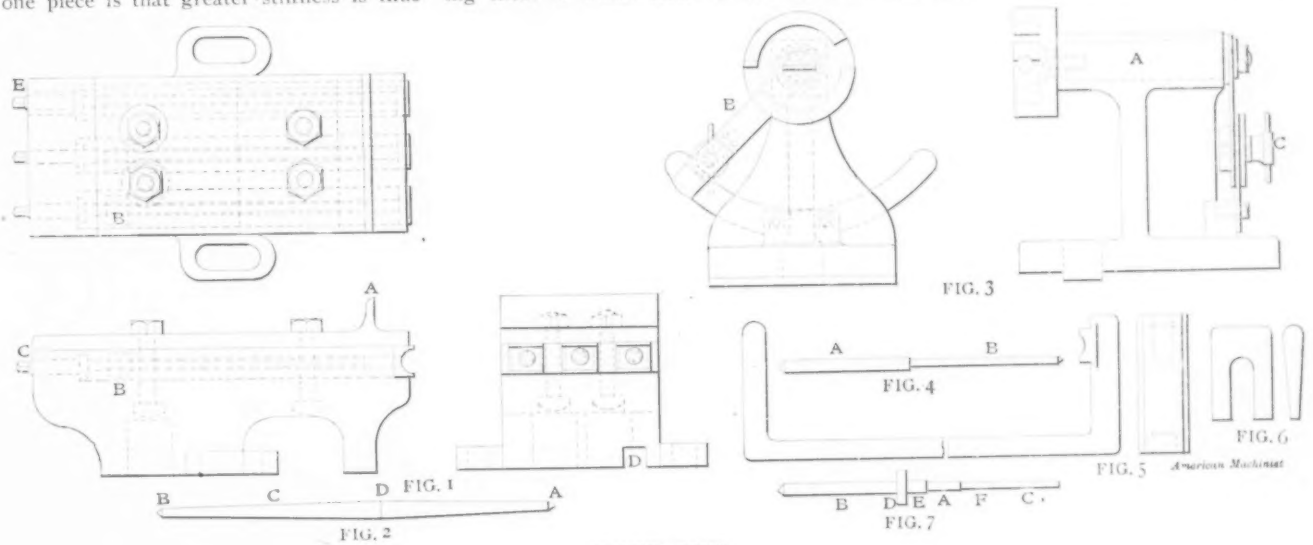
METHOD OF GRINDING A TAPER PIECE.

Fig. 2 shows a piece of work of which we have thousands to make; I will describe the method of grinding. These pieces come from the blacksmith shop .010 inch over finish size. End *A D* has a limit of error of .001 inch, and *B D* of .003 inch. After being pointed and straightened *A D* is ground, using the standard pattern rest with two shoes 1½ inches wide and a 36x2-inch emery wheel, running at a surface speed of 6,000 feet; 0.007 inch is removed in two cuts at the rate of 600 pieces per day. The pieces are then hardened on the point *A*, and then finished ground with the rest rigged up in the same manner as the rougher, only using a set wheel passing over once and back, removing .003 inch and bringing them to finish size. They are then taken to another grinder and *B D* ground, using a four-shoe rest. Three shoes 1¼ inch wide bear on the part being ground, and the fourth, a narrow one, cut down to ½ inch wide on the end, bears on the part previously ground, serving as a steady and keeping the two sections in line. The narrow rest bears close to the shoulder *D*; .010 inch of stock is removed during this operation in two cuts, passing over the work four times. After this grinding the pieces are straightened and ground at *C D*, using the special rest, Fig. 3.

A SPECIAL REST.

This rest was designed especially for this operation. One bearing is above the work and the other below. The shoe is turned with its carrier *A* by the handle *B*, which is clamped by the thumb-screw *C*. To put in a piece of work the operator swings the handle up, puts the work on the centers, brings the handle down until the shoe bearings touch the work, starts the work up and then brings the handle down tight and clamps it and proceeds to grind. The object of this grinding is to produce a true round spot on each piece with no variation in the taper. A small universal grinder is used for this operation. After the operator has put the work into the rest he brings the wheel up at *C*, Fig. 2, just sparking the work and grinds by *D*, removing about .002 inch at that point, as the taper is set a little nearer parallel than when grinding *B D*.

The reason for using this style of rest is that variation in the size of the work will not affect the taper being ground. With an ordinary back rest any variation in the size of the piece would cause a variation in the taper being ground, which would not do. This rest, having one support underneath and the other above the work, the variation in size does not prevent the work from bearing properly in the rest, as the operator pushes the handle down for each piece with the same pressure. The portion ground comes inside the shoe bearings, the wheel not touching where the shoe bears on the work. A flat center is used in the tailstock spindle, allowing the piece to adjust itself to its own center. The shoe is made of brass, and will run for a month at a time without being touched or changing taper.



GRINDER RESTS.

USE OF THE CLAMP REST.

There are lots of jobs of grinding on which we use a clamp rest to bring different surfaces ground concentric. Fig. 4 shows such a piece of work. End *A* is ground first and then *B*. When grinding the latter a five-shoe rest is used, four on *B* and a clamp rest on *A*, close to the shoulder. Fig. 5 shows the clamp used in connection with the standard pattern rest; it is a sliding fit in groove *D*, Fig. 1. Fig. 6 is a wedge, which the operator drives in between the clamp and the rest at *E*, Fig. 1, bringing the clamp up tight on the work.

FITTING UP NEW SHOES FOR THE RESTS.

When rigging up or putting in new shoes the operator files out a V in the end of each shoe, puts the shoes in the rest, places a reamer, the size of the fin-

ished work, on the centers and reams the shoes so that they will fit the finished piece. On our universal grinders, used for fine finishing, the shoes are all saved. We will say, for example, that the operator has been given some stock to grind down to 13-16 inch, having .004 to remove. This being a special job, he will use individual rests, requiring four, and will proceed like this: Picking out four new shoes, he places them in four rests; then placing a 13-16-inch reamer on the centers, reams the shoes one by one; then removing the reamer places his rests on the machine and proceeds to grind. After finishing the job he will remove the shoes, mark them 13-16 inch and put them away until there is more 13-16-inch stock to grind.

HANDLING WORK IN THE CENTER REST.

A center rest, with a hollow spindle in the headstock, comes in handy around the grinder. We had a job, Fig. 7, which we had to do with the center rest and hollow spindle. *A* is the bearing and must run dead true with portions *B* and *C*. They were 4 feet in length, and after roughing all over in the large grinder and finishing *B* and *C* we found that we could not finish *A* good enough there, so that the pieces would run perfect. The largest universal grinder that we had then would take in only 24 inches; so we devised the following scheme, which worked to perfection: On one grinder we had a hollow spindle and chuck and two center rests built exactly like a lathe center rest. We put in the hollow spindle, put on the chuck, placed the piece in the chuck with shoulder *D* resting against the chuck, and then located the center rests at *E* and *F*, leaving the end *C* to run free. As there was only two thousandths to remove, we ran the work slowly, so as not to cause any vibration in the end *C*, then put in a wheel suited to the conditions under which we were going to grind, and went ahead and came out all right. A hollow spindle and chuck can be used on quite a few grinding jobs. For example, one job we have is a piece 4 feet long, and after being ground straight all over one end has to have a taper 2¼ inches long ground on it. Now we can do this job on a short grinder, saving floor space and the cost of a longer grinder. The grinder we use will take in only 2 feet, but we rig up with a hollow spindle and chuck, clamp rest and spring tailstock; this gives a stiff support for the work and turns out just as good work as if ground on a longer grinder on centers.

SPECIAL CENTER FOR TAILSTOCK.

On our plain grinders, grinding such work as Fig. 2, we use what we call a multiple center. The tailstock moves crossways of the grinder plates and all adjustments for length are got by moving the headstock. In the tailstock we use a center 1-inch diameter with ten center holes in it, and as fast as one center burns out the operator turns the center around to the next hole, drives it back in and goes ahead with the grinding. On small work running fast, we have found this to be the best practise, as centers do not last long, and with a center with only one hole there is a great waste of steel.

A SUGGESTED IMPROVEMENT IN GRINDER DESIGN.

In conclusion, let me say that there is one thing about the grinder that could be changed to advantage, tho so far only one builder of grinders has adopted this modification. Design the grinder platen so that the T-slot will not be in line with the centers, but about 3 inches toward the front of the machine. This will admit of a design of rest that can be fastened to the table by means of bolts underneath the rest and not on the sides. Individual rests could then be placed side by side. We have one grinder built in this manner, and we find it much handier than with the style with the T-slot in line with the centers. Many other advantages develop with the new design as we use this grinder more. PAUL WESLEY.

Personal.

Loring Coes, inventor of the Coes wrench and president and treasurer of the Coes Wrench Company, Worcester, Mass., celebrates his ninety-third birthday on April 22. He is still inventing and still running the business. What are claimed to be the most meritorious of Mr. Coes' inventions have been placed on the market since his seventieth year. The original "knife-handle" wrench was patented when he was seventy-three, and he has taken out fifteen wrench patents since then. In the last four years he has invented and put upon the market two new styles of wrenches, and he has another nearly ready. Mr. Coes is now preparing for his forty-seventh annual fishing trip to the Rangeley Lakes.

Obituary.

Jacob S. Cramp, for many years foreman of the joiner department of the Cramp Shipbuilding Company, died in Philadelpia, April 15, sixty-nine years old. His father, Martin Cramp, was a brother of William Cramp, founder of the great shipbuilding plant.

Jonathan Hatch, formerly of the Smith & Winchester Company, South Windham, Conn., died at that place April 6, eighty-seven years old. He was apprenticed to the machinist trade at the shops of the above concern about seventy years ago, and later became the mechanical head of the company, which was at that time one of the largest paper machine building concerns in the country. He gradually acquired an ownership in the company and at the age of sixty disposed of his interests and retired from business.

Theodore Edwin Button, who died at Schenectady, N. Y., in March, sixty years old, was a son of Lysander Button, of Waterford, N. Y., one of the pioneer builders of hand and steam fire engines. He was graduated from Williams College in 1866 with special honors in mathematics and astronomy, and was offered a professorship in mathematics at Annapolis. He declined the offer and went into the fire-engine business with his father, inventing and perfecting many fundamental improvements. Mr. Button had lived in Schenectady the past fourteen years as a mechanical engineer and designer with the General Electric Company. Mr. Button had exceptional ability as an inventor and designer. The mechanism of the General Electric oil switches and circuit breakers was of his invention. A number of important patents were taken out by him and assigned to the company.

Business Items.

Beginning May 1, the general offices of the C. & C. Electric Company will be located at the works of the company at Garwood, N. J. A branch office will be established at 149 Broadway, New York.

Dodge & Day, engineers, Philadelphia, Pa., who have for the past three years designed the electrical equipment for operating the hoisting and conveying machinery built by the Dodge Coal Storage Company, will also have charge of similar work in connection with the telpherage apparatus that will now be manufactured by the Dodge Coal Storage Company as a result of its acquisition of the United Telpherage Company's interests.

Manufacturers.

The Bell Piano Company, Lynn, Mass., will erect a factory.

The Nashville (Tenn.) Bridge Company is erecting a plant.

The Montreal (Que.) Steel Company will enlarge its plant.

The Cleveland (O.) Twist Drill Company is erecting a new factory.

The Harriman (Tenn.) Hoe & Tool Company will enlarge its plant.

The Gordon Metal Company, Richmond, Va., will erect a new factory.

Ker & Goodwin, Brantford, Ont., machinists, will erect a new factory.

The Everett (Wash.) Interior Finishing Company will erect a new plant.

The Cleveland (O.) Hardware Company will erect a building, to cost $28,000.

The Barrett Tar Manufacturing Company is erecting a factory at Duluth, Minn.

The Fisher Machine Works, Leavenworth, Kansas, has been burned; loss, $50,000.

The Chicago & Northwestern Railroad is erecting new shops at Sioux City, Iowa.

The Des Moines (Ia.) Cement Block Company will triple the capacity of its plant.

S. Y. Hyde, La Crosse, Wis., will finance a tin can factory to be erected at that place.

The W. O. Brown Company, Dallas, Tex., buggy manufacturers, will erect a factory.

The plant of the Warren Electric Company, Sandusky, O., will be greatly enlarged.

L. F. Mott will erect a factory at Cedar Rapids, Ia., for making piano stools, benches, etc.

The Pocomoke Guano Company will put up a factory at Norfolk, Va., to cost $100,000.

The American Seeding Machine Company,

Springfield, Ohio, will erect a $15,000 addition.

J. George Leyner Engineering Works, Denver, Colo., contemplate more additions to their plant.

The Potthoff & Frey Iron Works, Cincinnati, O., will erect a steel manufacturing plant.

The McCaskey Register Company, Alliance, Ohio, proposes to erect an addition to its plant.

The Rugby Mining & Reduction Company, Mager, Ariz., will increase the capacity of its plant.

The plant of the Burroughs Adding Machine Company at Detroit, Mich., is to be enlarged.

The plant of the Art Bedstead Company, Chicago, Ill., has been burned; loss, about $100,000.

The Sterling Oil Works, Marietta, Ohio, is putting up a modern filtration building and washroom.

The Conway Stove Company, of Toledo, Ohio, will move to Fremont, O., erecting a factory there.

The State of Nebraska has appropriated $50,000 for a twine factory. The plant will be built at Lincoln.

The Krout & Fite Manufacturing Company will erect a textile plant, to cost $100,000, at Wayne Junction, Pa.

The Allis-Chalmers Company has decided to expend about $3,000,000 in improving its plant at West Allis, Wis.

It is reported that the American Can Company, New York, proposes erecting a branch factory in Savannah, Ga.

The Eddy Manufacturing Company, Worcester, Mass., razor manufacturers, will double the capacity of its plant.

The plant of the Carter & Hakes Machine Company, Winsted, Conn., was damaged by fire to the extent of $10,000.

The Southern Oak Extract Company, Knoxville, Tenn., will erect a large tannery in connection with its present plant.

The George D. Pohl Manufacturing Company, Vernon, N. Y., engines, etc., is contemplating an enlargement of its plant.

The Emerson Manufacturing Company, Rockford, Ill., agricultural implements, will make important additions to its plant.

An addition is being made to the factory of Norman Burdick & Sons, Albany, N. Y., manufacturers of stove specialties, etc.

James F. Ingraham, West Peabody, Mass., has purchased a tannery and will expend several thousand dollars for new machinery.

The Bravenan Manufacturing Company, Wilkesbarre, Pa., manufacturer of iron beds, springs, etc., will put up a new building.

It is reported that the Animal Trap Company, of Abingdon, Ill., will move to Detroit, Mich., where a factory will be erected.

Herbert L. Currier, Swampscott, Mass., has bought some land on which he will build a shop for the manufacture of gasoline engines.

The Morgan Silver Plate Company, Winsted, Conn., will erect an addition to its plant, and a 50 horse-power boiler will be installed.

The American Window Glass Company, Pittsburg, Pa., will, it is said, dismantle its factories in Indiana and rebuild at Bellvernon, Pa.

The Charlestown (Mass.) Gas & Electric Company will remodel its plant, preparatory to making its own gas, at an expenditure of $100,000.

The plant of the C. O. Bartlett & Snow Company, mill machinery manufacturer, at Cleveland, O., was destroyed by fire; loss, $100,000.

The American Solidifying Wood Company, of Marion, Ind., capitalized at $100,000, will move to Alexandria, Ind., where it will erect a factory.

The city of Sheffield, Ala., it is said, has secured a pipe works plant with a capital stock of $350,000, which will employ about 500 hands.

The Twin City Rapid Transit Company will move its plant from Minneapolis, Minn., to St. Paul, the shops at the latter place to be enlarged.

The Farlow Draft Gear Company, Baltimore, Md., organized with a capital of $250,000, will, it is thought, erect a plant in the near future.

The question of building a combination power and lighting plant in Camden, N. J., is being considered by the Public Service Corporation.

A company is being formed in Bridgeport, Conn., which will manufacture automobiles. J. H. Crossley and J. A. Morris, of that place, are interested.

The United States Cast Iron Pipe & Foundry Company, New York, will double the capacity of its plant at Bessemer, Ala., at a cost of $250,000.

The Oregon Railroad & Navigation Company will put up additional buildings to its shops at Portland, Ore. The improvements will cost $200,000.

The Spaulding Manufacturing Company, Grinnell, Iowa, will make additions to its factory, including a blacksmith shop and wood-working shop.

It is said that the Otto Gas Engine Works, of Philadelphia, Pa., have had drawings made of the ground plan of the proposed new plant at Wilmington, Del.

It is said that a new canning factory is proposed for Savannah, Ga. Solomon Sheftall, of S. Scheftall & Bro., of that place, is one of the promoters.

Transue & Williams, Alliance, O., manufacturers of drop forgings, are erecting an addition to their shops, the probable cost of which will be $20,000.

James M. Gossett, president of the Williamston (S. C.) Cotton Mills, has instituted a movement for the erection of another cotton mill at that place.

The Earl Chemical Company, Newtown Creek, Brooklyn, N. Y., is erecting a large plant on Staten Island, to which place it will move after completion.

A new mill company, capitalized at $60,000, will erect a cotton mill in Emporia, Va. Almon, Green & Co., Baltimore, Md., are interested in the project.

The Peters Shoe Company, St. Louis, Mo., is having plans prepared for a five-story factory building, to be erected in connection with its present factory.

The General Electric Company, Schenectady, N. Y., will shortly erect a brass foundry. All the latest machinery for the manufacture of brass will be installed.

It is reported that a wire and metal cable factory will be established in Mexico. The concession will be sought in the name of Henry Leschen, of St. Louis, Mo.

The B. F. Barnes Company, Rockford, Ill., is putting up an addition to its plant, to be used as a machine shop, which will be equipped with modern machinery.

The Simonds Manufacturing Company, Fitchburg, Mass., has had plans made for a new blacksmith shop. The company manufactures saws and machine knives.

Allegan, Mich., will have a new factory for manufacturing burial caskets and undertakers' supplies. M. D. Owen and Dr. F. C. Castell, of that place, are interested.

The Philadelphia & Reading Railway Company will increase the capacity of its shops at Reading, Pa., for which purpose an appropriation of $500,000 has been authorized.

The Atlantic Coast Line Railroad Company will build new shops at Waycross, Ga., to cost $400,000. The shops will be equipped with modern machinery and electrically driven.

A company with $20,000 capital has been formed to put up an electric lighting plant in Nuevo Laredo, Mex. Octaviano Gonzalez, postmaster of that place, is one of the promoters.

The Union Drawn Steel Company, Beaver Falls, Pa., cold rolled steel and shafting, is about to erect a branch mill at Hamilton, Ont. It will be called the Canadian Drawn Steel Company.

The Great Northern Railway, St. Paul, Minn., will make additions to its car shops at St. Cloud, Minn., among which will be a plant for the manufacture of frogs, switches and guard rails.

Otto Meinhausen, president of the American Copper, Brass & Iron Works, has bought land on Wellington street and Ashland avenue, Chicago, Ill., on which large machine works will be built.

The Daly Spike Company, of Detroit, Mich., has been formed, with H. W. Frost, formerly of the *Railway Age*, as president, whose present headquarters are at 614 Majestic Building, Detroit.

The Kaolin Putty Company has been organized, with headquarters in Louisville, Ky.; capital, $200,000. J. P. Venable, president of the Painters' Association of Louisville, is one of the incorporators.

The International Power Company, New York, has leased the rights of the Wilkerson Turbine Company, and it is stated that a plant will be erected in Birmingham, Ala., at an expense of $1,000,000.

The Ravenswood Paper Mill Company, of Long Island City, N. Y., has been incorporated with a capital stock of $25,000. The directors are Henry Schreiter, W. E. Warland, F. H. Warland, of Long Island City.

It is reported that the contract for the construction of the plant of the Southern Electric & Manufacuring Company at Anniston, Ala., will be awarded immediately. R. W. Munk, of Atlanta, Ga., is the superintendent of the company.

The American Grass Carpet Company, said to have a capital of $1,000,000, with $250,000 cash paid in, is looking for a site in Asbury Park, N. J., on which to erect a plant. W. Hampton de Fontaine, 29 Broadway, New York, represents the company.

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Punches & dies. Wal.M.Wks.,Waltham,Mass.

Will buy or pay royalty for good patented machine or tool. Box 282, AMER. MACHINIST.

Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N. J.

Wood patterns of every description; high-grade gas engine work a specialty. Trenton Pattern Works, Trenton, N. J.

Wanted—Near New York, Philadelphia or Washington, to buy or lease, small machine shop for model and die work. Address Box 3, AMERICAN MACHINIST.

Dies, jigs and fixtures; tools designed for special work; manufacturer of clockwork specialties and intricate mechanical instruments. D. S. Plumb, 57 E. Park st., Newark, N. J.

Medium size modern plant wants contracts;

close work on automatic and interchangeable machinery; will buy good tool or machine, or manufacture on royalty. Box 521, AM. M.

Wanted—Manufacturers to use premium system; shop cost reduced; output increased; no trouble with employees; system successfully installed; results guaranteed. Box 525, AMERICAN MACHINIST.

Gas and Oil Engines.—European M. E., Boat engine specialist, possessing several patentable constructions, wants to correspond with partner or company with capital. Address G., care T. C. Doornhagen, Bookseller, The Hague, Holland.

A Continental firm of machine tool importers, having large showroom in Paris, excellent connection and staff of travelers, require sole agency for first-class make of upright drilling machines up to 42 in. size, for France, Belgium and Switzerland. Reply Box 462, AMERICAN MACHINIST.

Modern foundry and machine shop, fully equipped for light and medium heavy work, wishes to manufacture engines, machines or machine parts; would undertake sale if desired; castings made in malleable, gray, brass, bronze and aluminum. Trenton Malleable Iron Co., Trenton, N. J., and 26 Cortlandt st., New York.

Wanted—In vicinity of New York, up-to-date boiler works and machine shop, fully equipped to take up the manufacture of steel plate tanks and apparatus for patented condensation water pumping process; parties willing to take an interest preferred; full investigation solicited; state facilities for turning out large orders in first-class manner. Box 8, AMERICAN MACHINIST.

Tool Machinery.—Wanted, as soon as possible, by a large German factory of tool machinery a specialist for a steady, well-paying position, in the manufacture of boring-bit chests, holding devices, special machines and apparatus for a rational manufacture of lathes and other tool machinery on a large scale. Practical engineers who have held similar positions in North America for a longer period of years and who are well versed in calculation, are preferred. Write Box 2, care AMERICAN MACHINIST.

For Sale.

Drawings and patterns complete for four sizes of upright drills. "Middle West," care AMERICAN MACHINIST.

For Sale—Machine shop in southern Michigan; good, live, paying business. Address Box 494, AMERICAN MACHINIST.

For Sale—Foundry and machine shop, equipped to build mine cars, stationary and marine gas engines and good line of patterns for jobbing work; two railroads, two navigable rivers. H. H. Mason, Mt. Carmel, Ill.

I can sell your machine shop (or other business), with or without real estate, no matter where it is or what it is worth. Send description, state price and learn how. W. M. Ostrander, 111 North American Bldg., Philadelphia.

Business Opportunities.

Engineer, having first-class Chicago office, would like to represent manufacturer. Address Box 21, AMERICAN MACHINIST.

We want a few thousand dollars to enlarge our business, and desire to interest a party who will take an active interest either as salesman, machinist or patternmaker. Address P. O. Box 216, Lewiston, Idaho.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be enclosed to unknown correspondents. Only bona fide situation want or help want advertisements inserted under this heading. Agency advertisements must be placed under Miscellaneous Wants.

Situations Wanted.

Classification indicates present address of advertiser, nothing else.

CONNECTICUT.

Position as chief draftsman or mechanical expert in designing and constructing machine tools, special machinery, etc., by man with ample experience in these lines; member A. S. M. E. Address Box 17, AMER. MACH.

Mechanical engineer, good executive ability, well up on modern time and cost systems, ample experience in designing and constructing machinery; 14 years superintendent, wants similar position. Address Box 18, AMERICAN MACHINIST.

ILINOIS.

Member A. S. M. E., 10 years as chief draftsman and leading designer of hoisting machinery; steam, electric, hydraulic and hand cranes; traveling, gantry, R. R. wrecking, jib, pillar, etc., 1 to 150 tons; also proposals, specifications and shop methods of building cranes; seeks wider field than present employers can offer. Box 500, AM. M.

MASSACHUSETTS.

Mechanical draftsman wishes position. Address Box 28, AMERICAN MACHINIST.

Gray iron foundry superintendent wishes to change; engines, machinery; practical in all departments; up to date; good references. Address Box 542, AMERICAN MACHINIST.

MICHIGAN.

Draftsman, an expert in the design of presses and sheet-metal working machinery, wants a change. Box 14, AMER. MACH.

Mechanical engineer, with extensive experience on automatic and special machinery, tools and fixtures for interchangeable manufacturing at low cost, seeks employment in this line. Box 15, AMERICAN MACHINIST.

NEW JERSEY.

Situation wanted by a first-class mechanical draftsman and designer; 20 years' experience in heavy sawmill work, air compressors and Corliss engines; A1 reference. Address Box 530, AMERICAN MACHINIST.

Practical mechanic, aged 27, draftsman, at present assistant superintendent, desires superintendency with small manufacturer; object, interest in business; specialty, drop forge business. Address Box 7, AM. MACH.

NEW YORK.

Mechanical draftsman wishes position; valves. Address Box 30, AMER. MACHI

Mechanical draftsman, technical graduate, desires position; salary $18. Box 10, A. M.

Draftsman, mechanical, technical graduate, 6 years' experience, wants position. Box 13, AMERICAN MACHINIST.

Mechanical draftsman, age 24, for detailing out and tracing, desires position. Box 20, AMERICAN MACHINIST.

Mechanical draftsman (graduate), age 25, with shop and office practice, desires position. Box 32. AMERICAN MACHINIST,

Position as superintendent or chief draftsman wanted with a manufacturing concern; 15 years' practical experience. Box 31, A. M.

Electrical and mechanical engineer, with 9 years' experience in factory and power plant work, desires position with consulting engineer or factory. Address Box 27, A. M.

Mechanical engineer, experienced in foundry and machine shop management and in the design and construction of cranes, hoists and allied machinery, wishes to change. Box 11, AMERICAN MACHINIST.

General manager, familiar with modern methods of manufacturing, marketing and accounting, and having the best of banking and commercial connections, is open for engagement. Box 9, AMERICAN MACHINIST.

Civil, mechanical and electrical engineer desires a position; recently connected with the Westinghouse Company; would represent manufacturers in the East; age 35 years. Box 19, AMERICAN MACHINIST.

Mechanical engineer, German, with 9 years' experience here and abroad, wishes to engage with a concern willing to manufacture or to establish branch office abroad. Address Box 26, AMERICAN MACHINIST.

Mechanical engineer, 12 years' experience, desires change; up to date on tools and fixtures, cost reduction and shop management; successful in the design and construction of hoisting and conveying machinery; experienced estimator and correspondent. Box 16, AMERICAN MACHINIST.

Experienced specialist in the construction of modern centrifugal pumps for high and low pressure. Department director of an A1 German machine manufacturing establishment desires to accept a position in the U. S.; he will guarantee the efficiency of centrifugal pumps of his own construction up to 78 per cent. Address V 1246 B. Europe, care Albert Frank & Co., Advertising Agents, 25 Broad st., New York City.

OHIO.

Young man, 31, American, married, experienced foreman, toolmaker and machinist, little theory, much practical experience, wants high-grade place at once; anywhere. "Settler," care AMERICAN MACHINIST.

PENNSYLVANIA.

Draftsman, 9 years at steam engines, pumps and hydraulic machinery, wishes situation; good designer; any location. Box 540, A. M.

Mechanical draftsman, German, college graduate, 2 years' shop experience, 2½ years' office experience special tool machines and hydraulic presses, wants position; will go anywhere. Box 1, AMERICAN MACHINIST.

WEST OF MISSISSIPPI.

Position Wanted.—Mechanical and structural engineer, expert draftsman; 11 years' varied experience; capable works manager, contracting engineer or superintendent; at present with large gold dredging company; open after May 1, and will go anywhere. Address D. A. Wright, care Folsom Development Co., Folsom, Cal.

Help Wanted.

Classification indicates present address of advertiser, nothing else.

CANADA.

Wanted—A mechanical superintendent for one of the largest and best equipped machine tool, press and general machinery plants in Canada; one who will take a reasonable financial interest in the business; must have thorough knowledge of costs, handling men, master details, produce results and be capable of producing accurate interchangeable work advantageously; state age, experience, last positions filled, references and salary wanted. Box 511, AMERICAN MACHINIST.

CONNECTICUT.

Wanted—Six first-class patternmakers on heavy machinery work; good wages; no trouble. Address Farrel Foundry & Machine Co., Ansonia, Conn.

GEORGIA.

Wanted—One first-class toolmaker; must understand designing special tools for turret lathes and gas engine work; also one first-class all-round man for general shopwork; must be a hustler and know how to handle modern machine tools and high speed steels to their limit. Address Columbus Iron Works Co., Columbus, Ga.

ILINOIS.

Wanted—First-class toolroom foreman, thoroughly experienced in automobile, stamping and similar dies; salary $1,600 to start. Engineering Agency, Chicago.

Engineers and Draftsmen—Send 10c. in stamps for May issue of the *Engineering World*, containing the Engineering Agency's list of 150 positions open for engineers, draftsmen, superintendents, instructors, etc. The Engineering Agency, Chicago.

Wanted—Engineer, competent to supervise the construction of large steel buildings adapted for manufacturing purposes, and who has had experience upon similar work; also an experienced building inspector and architectural and structural draftsmen familiar with machine shop construction and design; applicants should give in detail their experience, qualifications and references, enclosing copies of letters of reference, and state age, salary expected and how soon they will report for duty if engaged. Address "Buildings," P. O. Box 1065, Chicago, Ill.

INDIANA.

Wanted—Machinist; a first-class man as fitter on screw machines. Box 392, AM. M.

Wanted—A competent, experienced man to take charge of assembling departments in automobile factory; must be able to run on strictly up-to-date manufacturing methods; state experience, references and salary wanted. Address Box 25, AMER. MACHINIST.

MASSACHUSETTS.

Wanted—Inspector and assistant superintendent for large gear cutting shop. Address "Gears," care AMERICAN MACHINIST.

Foreman—For a growing factory building scientific apparatus; want a rapid worker, having ability to design details; good opportunity for the right man. Box 5, AM. M.

Wanted—Young technical graduates, both electrical and mechanical engineers, for testing steam turbines and electric generators. Apply to Testing Department, General Electric Company, West Lynn, Mass.

Wanted—By Boston house long established, experienced mechanic to take charge of 40 or 50 hands on high-grade steel and brass work; must have best reference; state amount and kind of experience. Address J. Z., care AMERICAN MACHINIST.

MICHIGAN.

Draftsman wanted; must be accurate and experienced in checking drawings, determining shop limits for new designs and making out lists of parts; give full particulars regarding experience, age and salary expected. Box 524, AMERICAN MACHINIST.

NEW JERSEY.

Lathe, planer and boring mill operators wanted for night shift; those accustomed to

machine tool work preferred; steady work and good pay to good men. Address the Pond Machine Tool Co., Plainfield, N. J.

First-class boring-mill, lathe and planer hands should file applications with us, as the constant and rapid growth of our business is always calling for additions to our force; our plant is modern in every respect and is located in a suburb of New York, where there is plenty of room, air and sunlight. Remember, we pay first-class wages and want only competent men. Henry R. Worthington Hydraulic Works, Harrison, N. J.

NEW YORK.

Wanted—First-class draftsman; preferably familiar with pumps; give experience, etc. Box 24, AMERICAN MACHINIST.

Wanted—First-class draftsman who has had experience in designing dredging machinery. Apply Chas. Leffler & Co., 61 Clymer st., Brooklyn, N. Y.

Designer for tools and fixtures, who is posted on good shop methods and familiar with steam pump or engine work. Address Box 536, AMERICAN MACHINIST.

Wanted—Several first-class draftsmen; give age, experience, reference and salary expected. Apply to Engineer in Charge, Drafting department, General Electric Co., Schenectady, N. Y.

Auditor wanted for large manufacturing company; experienced in cost systems; able executive; salary $3,000; other managerial, clerical and technical positions on file; write for list and plan. Business Opportunity Company, 1 Union Square, New York.

Mechanical or electrical engineer wanted: a large manufacturing company near New York has good opening for bright young man familiar with construction work, modern shop methods, installation of machinery, piping, etc.; applicants should give experience, reference, age and salary desired. Box 23, AMERICAN MACHINIST.

Chief engineer wanted for a large works, manufacturing several lines of modern machinery and appurtenances for complete installations; a high-grade, technically educated and thoroughly practical man is required, who has had extensive experience in all branches of engineering in connection with shop work and the installation of machinery; must be a man of first-class executive ability; please give age, references, previous experience and compensation desired. A. B. C., P. O. Box 822, N. Y. City.

An old-established and large corporation, manufacturing and selling machinery of various kinds, including large engines, compressors, etc., is looking for a high-class, comprehensive man to take entire charge of its sales department; must be a man of broad experience and unquestioned executive ability, fully competent to handle salesmen and agencies and accustomed to negotiating large and important contracts; in answering, please give age, previous experience, references and compensation expected. X. Y. Z., care A. M.

OHIO.

Wanted—A man who can and will sell machine knives; only an expert salesman need apply, or one who could at once handle the trade; give reference. Address O. K., care AMERICAN MACHINIST.

Wanted—An experienced air compressor salesman, thoroughly conversant with the different applications of compressed air; to the right person a most satisfactory proposition will be made; all applications strictly confidential. Address Box 22, AM. MACH.

PENNSYLVANIA.

Machine and floor hands, familiar with machine tool work. Standard Engineering Works, Ellwood City, Pa.

Experienced mechanical draftsman wanted at once at steel works in Eastern Pennsylvania. "Mechanical," care AMER. MACH.

Wanted—First-class draftsman on mill construction and equipment; technical man preferred. Box 4, AMERICAN MACHINIST.

Wanted—Experienced draftsmen in electrical apparatus, switchboard motors and generators; only first-class men need apply; state experience and salary expected. Box 29, AMERICAN MACHINIST.

WISCONSIN.

Foreman, with experience for erecting and assembling machine tools. Box 6, AM. M.

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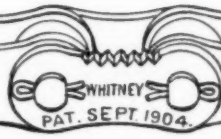

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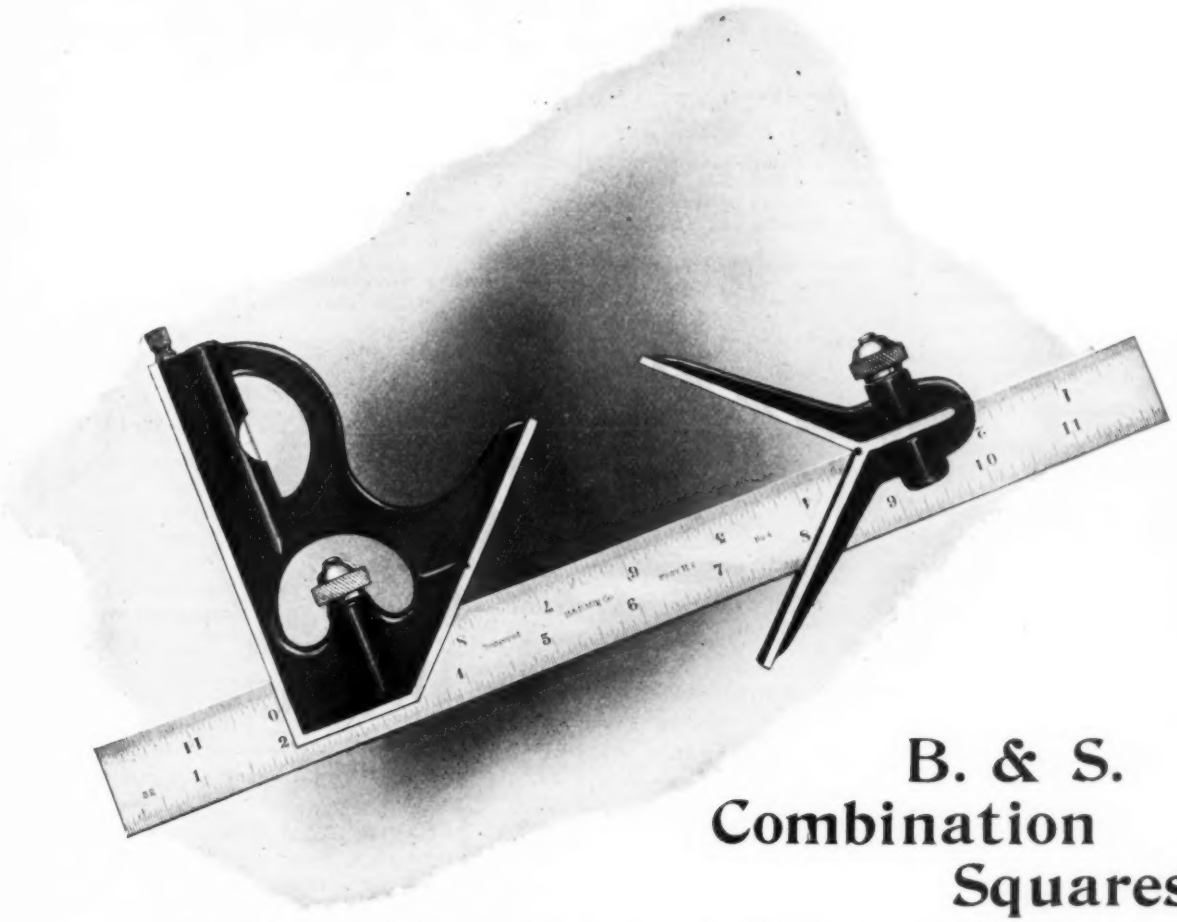

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Electric Controller & Supply Co., Cleveland, O.
Electro Dynamic Co., Bayonne, N. J.
General Elec. Co., New York.
Northern Elec. Mfg. Co., Madison, Wis.
Roth Bros. & Co., Chicago, Ill.
Stanley Elec. Mfg. Co., Pittsfield, Mass.
Triumph Elec. Co., Cincinnati, O.
Westinghouse Electric & Mfg. Co., Pittsburg, Pa.

Electrically Driven Tools and Machinery
American Tool Wks. Co., Cin., O.
Electric Controller & Supply Co., Cleveland, O.
Hisey-Wolf Mach. Co., Cincin., O.

Elevators
Albro-Clem Elevator Co., Philadelphia, Pa.
Curtis & Co. Mfg. Co., St. Louis, Mo.
Morse, Williams & Co., Phila., Pa.

Emery Wheel Dressers
Desmond-Stephan Mfg. Co., Urbana, O.
Diamond Saw & Stamping Wks., Buffalo, N. Y.
Heald Machine Co., Worcester, Mass.
Standard Tool Co., Cleveland, O.

Emery Wheels
See Grinding Wheels.

Enclosures, Tool-room
Merritt & Co., Philadelphia, Pa.

Engineers, Electrical
Crocker-Wheeler Co., Ampere, N. J.

Engines, Automobile
Franklin Mfg. Co., Syracuse, N. Y.
Olds Gasoline Engine Works, Lansing, Mich.

Engines, Gas and Gasoline
Abenaque Mach. Wks., Westminster Station, Vt.
Backus Water Motor Co., Newark, N. J.
Columbus Mach. Co., Columbus, O.
Foos Gas Eng. Co. Springfield, O.
Jacobson Mach. & Mfg. Co., Warren, Pa.
Mietz, August, New York.
New Era Gas Engine Co., Dayton, Ohio.
Olds Gasoline Engine Wks., Lansing, Mich.
Struthers-Wells Co., Warren, Pa.

Engines, Oil
International Power Vehicle Co., Stamford, Conn.
Mietz, August, New York.

Engines, Steam
Buffalo Forge Co., Buffalo, N. Y.
Rand Drill Co., New York.
Ridgway Dynamo & Engine Co., Ridgway, Pa.
Struthers-Wells Co., Warren, Pa.
Sturtevant Co., B. F., Hyde Park, Mass.

Engraving Machinery
Gorton Mach. Co., Geo., Racine, Wis.

Exhaust Heads
Sturtevant Co., B. F., Hyde Park, Mass.

Exhibition, Machinery
Philadelphia Bourse, Phila., Pa.

Fans, Electric
General Electric Co., New York.
Northern Elec. Mfg. Co., Madison, Wis.
Sprague Elec. Co., New York.
Sturtevant Co., B. F., Hyde Park, Mass.
Westinghouse Elec. & Mfg. Co., Pittsburg, Pa.

Fans, Exhaust
Sturtevant Co., B. F., Hyde Park, Mass.

Files and Rasps
Barnett Co., G. & H., Phila., Pa.
Hammacher, Schlemmer & Co., New York.
Nicholson File Co., Prov., R. I.
Reichheim & Co., E. P., New York.

File Cleaners
Miller, Horatio L., Worcester, Mass.

Filler, Iron
Clark Cast Steel Cement Co., Shelton, Conn.
Felton, Sibley Co., Phila., Pa.

Filters, Oil
Houghton & Co., E. F., Philadelphia, Pa.

Flexible Shafts
Chicago Flexible Shaft Co., Chicago, Ill.
Coates Clipper Mfg. Co., Worcester, Mass.

Forges
Boynton & Plummer, Worcester, Mass.
Buffalo Forge Co., Buffalo, N. Y.
Ingersoll-Sergeant Drill Co., New York.
Miner & Peck Mfg. Co., New Haven, Conn.
Sturtevant Co., B. F., Hyde Park, Mass.

Forgings, Drop
Billings & Spencer Co., Hartford, Conn.
Page-Storms Drop Forge Co., Springfield, Mass.
Solid Steel Tool & Forge Co., Pittsburg, Pa.
Williams & Co., J. H., Brooklyn, N. Y.
Wyman & Gordon, Worcester, Mass.

Forgings, Hydraulic
Wyman & Gordon, Worcester, Mass.

Forgings, Steel
Baldwin Steel Co., New York.
Heppenstall Forge & Knife Co., Pittsburg, Pa.
Page-Storms Dron Forge Co., Springfield, Mass.
Solid Steel Tool & Forge Co., Pittsburg, Pa.
Wyman & Gordon, Worcester, Mass.

Forming Machines
Hartford Mch. Screw Co., Hartford, Conn.

Foundry Furnishings
Obermayer Co., S., Cincinnati, O.
Paxson Co., J. W., Phila., Pa.
Stevens, F. B., Detroit, Mich.
Sturtevant Co., B. F., Hyde Park, Mass.

Furnaces, Gas
Am. Gas Furnace Co., N. Y. City.
Chicago Flexible Shaft Co., Chicago, Ill.
Westmacott Co., J. M., Providence, R. I.

Furniture, Machine Shop
New Britain Mach. Co., New Britain, Conn.

Gauges, Recording
Bristol Co., Waterbury, Conn.

Gauges, Standard
Brown & Sharpe Mfg. Co., Providence, R. I.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Hartford, Conn.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Sawyer Tool Mfg. Co., Fitchburg, Mass.
Slocomb Co., J. T., Prov., R. I.
Starrett Co., L. S., Athol, Mass.

Gauges, Steam
American Steam Gauge & Valve Mfg. Co., Boston, Mass.
Lunkenheimer Co., Cincinnati, O.

Gear Cutting Machinery
Adams Co., Dubuque, Iowa.
Becker-Brainard Milling Mach. Co., Hyde Park, Mass.
Bickford Drill & Tool Co., Cin., O.
Brown & Sharpe Mfg. Co., Providence, R. I.
Clough, R. M., Tolland, Conn.
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, Rochester, N. Y.
Gould & Eberhardt Newark, N. J.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Hartford, Conn.
Sloan & Chace Mfg. Co., Newark, N. J.
Whiton Machine Co., D. E., New London, Conn.

Gear Testing Machinery
Gisholt Mach. Co., Madison, Wis.

Gears, Cut
Bilgram, Hugo, Philadelphia, Pa.
Boston Gear Wks., Boston, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Caldwell & Son Co., H. W., Chicago, Ill.
Cresson Co., Geo. V., Phila., Pa.
Davis, Rodney, Philadelphia, Pa.
Earle Gear & Mach. Co., Philadelphia, Pa.
Eberhardt Bros. Mach. Co., Newark, N. J.
Fawcus Mch. Co., Pittsburg, Pa.
Fellows Gear Shaper Co., Springfield, Vt.
Foote Bros. Gear & Mach. Co., Chicago, Ill.
Ganschow, Wm., Chicago, Ill.
Gleason Works, Rochester, N. Y
Gould & Eberhardt, Newark, N. J
Grant Gear Works, Boston, Mass
Harrington, Son & Co., Edwin Philadelphia, Pa.
Horsburgh & Scott Co., The Cleveland, O.
Massey Mach. Co., Watertown N. Y.
Messmer Mfg. Co., Ferd., St. Louis, Mo.
New Process Raw Hide Co., Syracuse, N. Y.
Nuttall Co., R. D., Pittsburg, Pa
Patterson, Gottfried & Hunter Ltd., New York.
Philadelphia Gear Wks., Philadelphia, Pa.
Sawyer Gear Wks., Cleveland, O
Simonds Mfg. Co., Pittsburg, Pa.
Taylor-Wilson Mfg. Co., Allegheny, Pa.

Gears, Molded
Caldwell & Son Co., H. W., Chicago, Ill.
Farrel Fdry. & Mach. Co., Ansonia, Conn.
Franklin Mfg. Co., Syracuse, N. Y
Greenwald Co., I. & E., Cincin., O
Taylor-Wilson Mfg. Co., Allegheny, Pa.

Gears, Rawhide
Boston Gear Wks., Boston, Mass
Chicago Raw Hide Mfg. Co., Chicago, Ill.
Earle Gear & Mach. Co., Philadelphia, Pa.
Fawcus Mch. Co., Pittsburg, Pa.
Gould & Eberhardt, Newark, N. J
Horsburgh & Scott Co., Cleveland, Ohio.
New Process Raw Hide Co., Syracuse, N. Y.
Nuttall Co., R. D., Pittsburg, Pa.

Gears, Worm
Albro-Clem Elevator Co., Philadelphia, Pa.
Boston Gear Wks., Boston, Mass.
Fawcus Mch. Co., Pittsburg, Pa.
Gould & Eberhardt, Newark, N. J.
Grant Gear Works, Boston, Mass.
Morse, Williams & Co., Phila., Pa.
Nuttall Co., R. D., Pittsburg, Pa.
Philadelphia Gear Works, Philadelphia, Pa.
Simonds Mfg. Co., Pittsburg, Pa.
Taylor-Wilson Mfg. Co., Allegheny, Pa.

Graphite
Dixon Crucible Co., Jos., Jersey City, N. J.
Obermayer Co., S., Cincinnati, O.

Grinders, Cutter
Coates Clipper Mfg. Co., Worcester, Mass.
Heald Mch. Co., Worcester, Mass.
Hisey-Wolf Mach. Co., Cincin., O.
Mueller Mch. Tool Co., Cin., O.
Niles-Bement-Pond Co., New York.

Grinders, Cock
Bath Grinder Co., Fitchburg, Mass.
Windsor Mach. Co., Windsor, Vt.

Grinders, Cutter
Automatic Mach. Co., Greenfield, Mass.
Bath Grinder Co., Fitchburg, Mass.
Becker-Brainard Milling Mach. Co., Hyde Park, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mach. Co., Cincinnati, O.
Garvin Machine Co., New York.
Gould & Eberhardt, Newark, N. J.
Greenfield Mach. Co., Greenfield, Mass.
Heald Mach. Co., Worcester, Mass.
Hisey-Wolf Mach. Co., Cincin., O.
Niles-Bement-Pond Co., New York.
Norton Emery Wheel Co., Worcester, Mass.
Pratt & Whitney Co., Hartford, Conn.
Rivett-Dock Co., Boston, Mass.

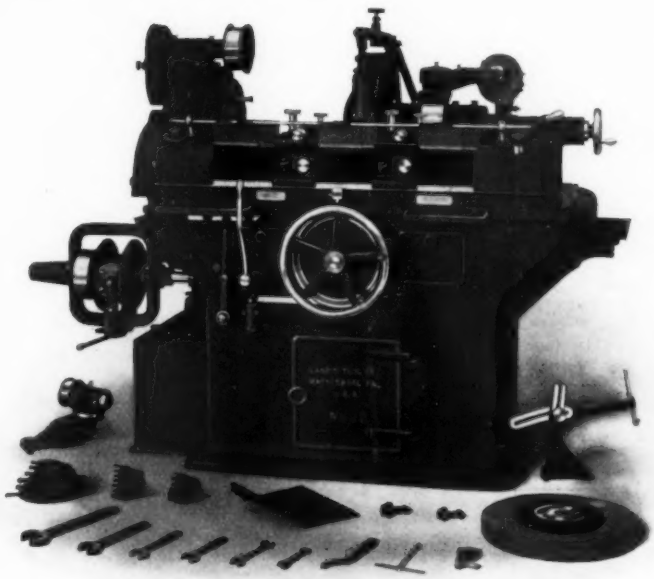
Grinders, Disk
Bath Grinder Co., Fitchburg, Mass.
Besly & Co., Chas. H., Chicago, Ill.
Diamond Mach. Co., Provi., R. I.
Heald Machine Co., Worcester, Mass.
Iroquois Mach. Co., New York.
Ney, R. W., Kingston, N. Y.
Ransom Mfg. Co., Oshkosh, Wis.

Grinders, Drill
Bath Grinder Co., Fitchburg, Mass.
Heald Mch. Co., Worcester, Mass.
Niles-Bement-Pond Co., New York.
Standard Tool Co., Cleveland, O.

Grinders, Portable
Heald Machine Co., Worcester, Mass.
Hisey-Wolf Mach. Co., Cincin., O.

Grinders, Tool
Armstrong Bros. Tool Co., Chicago, Ill.
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Bath Grinder Co., Fitchburg, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Diamond Mach. Co., Prov., R. I.
Gisholt Mach. Co., Madison, Wis.
Gould & Eberhardt, Newark, N. J.
Hisey-Wolf Mach. Co., Cincin., O.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Niles-Bement-Pond Co., New York.
Ransom Mfg. Co., Oshkosh, Wis.
Safety Emery Wheel Co., Springfield, O.
Standard Tool Co., Cleveland, O.
Vandyck Churchill Co., New York.
Whitney Mfg. Co., Hartford, Ct.

Grinding and Polishing Machines
Besly & Co., Chas. H., Chicago, Ill.
Blount Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Builders' Iron Foundry, Providence, R. I.
Coates Clipper Mfg. Co., Worcester, Mass.

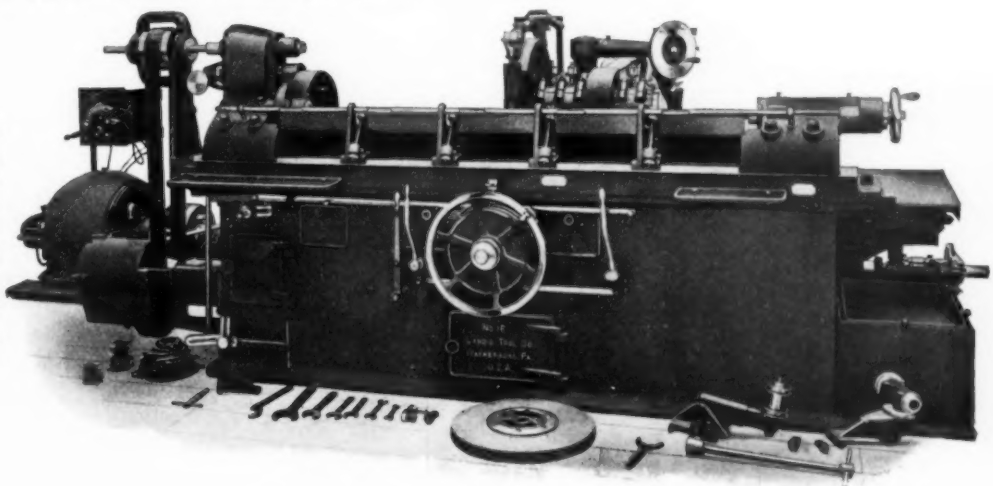


No. 22 Plain Grinding Machine. Capacity, 12" swing and 34" between centers.

Landis Grinders Are Built In Several Sizes.

All styles contain the several important features that have made the "LANDIS" famous throughout the world as a rapid accurate, profit-producing tool. There is one style that meets your requirements exactly, no matter what your needs are. The No. 16 Plain Grinder, illustrated here, shows suitability and convenience of motor drive without overhead work. The capacity of of this tool is 1½ cubic inches of metal per minute.

Make us acquainted withyourrequirements and we'll make you acquainted with thebest tool to be had for your shop.



No. 16 Plain Grinder Arranged for Electric or Belt Drive.

Landis Tool Company, Waynesboro, Pa., U.S.A.

AGENTS—Walter H. Foster Co., 513 Williamson Building, Cleveland, Ohio. Walter H. Foster Co., 114 Liberty St., New York. C. W. Burton, Griffiths & Co., London. Schuchardt & Schutte, Berlin, Vienna, Stockholm, St. Petersburg. Alfred H. Schutte, Cologne, Brussels, Liege, Milan, Paris and Bilbao. A. R. Williams Machinery Co., Toronto. Williams & Wilson, Montreal, Canada.

Study the shape of this die and the manner in which it is held—note how the chasers can be set forward as fast as the cutting edges are worn—and you will readily understand why it will do **20 times the work of a hobbed die.** Then write for particulars of the **LANDIS BOLT CUTTER.**

LANDIS MACHINE CO., WAYNESBORO, PA., U.S.A.

Grinding and Polishing Machines—*Continued*

Diamond Mach. Co., Prov., R. I.
Fairbanks Co., New York.
Goodell-Pratt Co., Greenfield, Mass.
Greenfield Mach. Co., Greenfield, Mass.
Hill, Clarke & Co., Boston, Mass.
Iroquois Mach. Co., New York.
Landis Tool Co., Waynesboro, Pa.
Marshall & Huschart Mchry. Co., Chicago, Ill.
Niles-Bement-Pond Co., New York.
Northern Elec. Mfg. Co., Madison, Wis.
Norton Emery Wheel Co., Worcester, Mass.
Norton Grinding Co., Worcester, Mass.
Prentiss Tool & Supply Co., New York.
Ransom Mfg. Co., Oshkosh, Wis.
Rivett-Dock Co., Boston, Mass.
Royersford Fdry. & Mach. Co., Royersford, Pa.
Safety Emery Wheel Co., Springfield, O.
Standard Tool Co., Cleveland, O.
Vandyck Churchill Co., New York.
Vitrified Wheel Co., Westfield, Mass.

Grinding Wheels

Abrasive Material Co., Philadelphia, Pa.
Adams Co., Dubuque, Iowa.
Builders' Iron Foundry, Providence, R. I.
Carborundum Co., Niagara Falls, N. Y.
Diamond Mach. Co., Prov., R. I.
Hampden Cor. Wheel Co., Brightwood, Mass.
Houghton & Co., E. F., Philadelphia, Pa.
National Corundum Wheel Co., Buffalo, N. Y.
Niles-Bement-Pond Co., New York.
Norton Emery Wheel Co., Worcester, Mass.
Safety Emery Wheel Co., Springfield, O.
Vitrified Wheel Co., Westfield, Mass.
Whitney Mfg. Co., Hartford, Ct.

Grindstones and Frames

Athol Machine Co., Athol, Mass.
Niles-Bement-Pond Co., New York.

Gun Barrel Machinery

Diamond Mach. Co., Prov., R. I.
Pratt & Whitney Co., Hartford, Conn.

Hack Saw Blades and Frames

Diamond Saw & Stamping Wks., Buffalo, N. Y.
Goodell-Pratt Co., Greenfield, Mass.
Hammacher, Schlemmer & Co., New York.
Patterson, Gottfried & Hunter, Ltd., New York.
Starrett Co., L. S., Athol, Mass.
West Haven Mfg. Co., New Haven, Conn.

Hack Saws, Power

Diamond Saw & Stamping Wks., Buffalo, N. Y.
Fairbanks Co., New York.
Hoefer Mfg. Co., Freeport, Ill.
Niles-Bement-Pond Co., New York.
West Haven Mfg. Co., New Haven, Conn.

Hammers, Electric

Northern Elec. Mfg. Co., Madison, Wis.

Hammers, Drop

Billings & Spencer Co., Hartford, Conn.
Bliss Co., E. W., Brooklyn, N. Y.
Chambersburg Engineering Co., Chambersburg, Pa.
Gould & Eberhardt, Newark, N. J.
Merrill Bros., Brooklyn, N. Y.
Miner & Peck Mfg. Co., New Haven, Conn.
Niles-Bement-Pond Co., New York.
Perkins Mach. Co., Warren, Mass.
Waterbury Farrel Fdry. & Mach. Co., Waterbury, Conn.

Hammers, Pneumatic

Cleveland Pneumatic Tool Co., Cleveland, O.
Dallett Co., Thos. H., Phila., Pa.
Ingersoll-Sergeant Drill Co., New York.
International Steam Pump Co., New York.
Niles-Bement-Pond Co., New York.
Rand Drill Co., New York.

Hammers, Power

Niles-Bement-Pond Co., New York.
Scranton & Co., The, New Haven, Conn.
Sutton Co., C. E., Toledo, O.

Hammers, Steam

Bethlehem Fdry. & Mach. Co., So. Bethlehem, Pa
Chambersburg Engineering Co., Chambersburg, Pa.
Vandyck Churchill Co., New York.

Handles, Screw Plate

Standard Welding Co., Cleve., O.

Hangers, Shafting

Cresson Co., Geo. V., Phila., Pa.
Hyatt Roller Bearing Co., Harrison, N. J.
Pryibil, P., New York.

Heaters, Feed Water

Sturtevant Co., B. F., Hyde Park, Mass.

Heating and Ventilating Apparatus

Buffalo Forge Co., Buffalo, N. Y.
Sturtevant Co., B. F., Hyde Park, Mass.

Heating Machines

Am. Gas Furnace Co., New York.

Hoisting and Conveying Machinery

Brown Hoisting Mchry. Co., New York.
Caldwell & Son Co., H. W., Chicago, Ill.
Cresson Co., Geo. V., Phila., Pa.
Eastern Mchy. Co., New Haven, Conn.
Hoist Mfg. & Const. Co., Philadelphia, Pa.
Link Belt Engineering Co., Philadelphia, Pa.
Niles-Bement-Pond Co., New York.

Hoists, Electric

C & C Electric Co. New York.
Cleveland Crane & Car Co., Wickliffe, Ohio.
Curtis & Co. Mfg. Co., St. Louis, Mo.
General Pneu. Tool Co., Montour Falls, N. Y.
Maris Bros., Philadelphia, Pa.
Niles-Bement-Pond Co., New York.
Northern Engineering Works, Detroit, Mich.
Sprague Electric Co., New York.
Sturtevant Co., B. F., Boston, Mass.
Yale & Towne Mfg. Co., New York.

Hoists, Hand

Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hoist Mfg. & Const. Co., Philadelphia, Pa.
International Steam Pump Co., New York.
Yale & Towne Mfg. Co., New York.

Hoists, Pneumatic

Curtis & Co. Mfg. Co., St. Louis, Mo.
General Pneumatic Tool Co., Montour Falls, N. Y.
International Steam Pump Co., New York.
Rand Drill Co New York.

Igniters, Gas Engine

Franklin Mfg. Co., Syracuse, N. Y.

Indicators, Speed

Norton Emery Wheel Co., Worcester, Mass.
Starrett Co., L. S., Athol, Mass.

Indicators, Speed, Peripheral

Warner Instrument Co., Beloit, Wis.

Indicators, Steam

American Steam Gauge & Valve Mfg. Co., Boston, Mass.

Industrial Railways

Hunt Co., C. W., West New Brighton, N. Y.
Sturtevant Co., B. F., Hyde Park, Mass.

Injectors

Desmond-Stephan Mfg. Co., Urbana, O.
Lunkenheimer Co., Cincinnati, O.
Sellers & Co., Wm., Phila., Pa.

Inspection and Tests

Hunt Co., Robt. W., Chicago, Ill.

Instruction Schools

See Schools, Correspondence.

Insurance, Boiler

Hartford Steam Boiler Insp. & Ins. Co., Hartford, Conn.

Jacks, Hydraulic

Bethlehem Fdry. & Mach. Co., So. Bethlehem, Pa.
Watson-Stillman Co., New York.

Jacks, Planer

Armstrong Bros. Tool Co., Chicago, Ill.

Key Seaters

Baker Bros., Toledo, O.
Chattanooga Mchry. Co., Chattanooga, Tenn.
Davis Mach. Co., W. P., Rochester, N. Y.
Niles-Bement-Pond Co., New York.
Whitney Mfg. Co., Hartford, Ct.

Keys, Machine

Standard Gauge Steel Co., Beaver Falls, Pa.
Whitney Mfg. Co., Hartford, Ct.

Lamps, Arc

General Electric Co., N .Y. City.
Stanley Elec. Mfg. Co., Pittsfield, Mass.
Westinghouse Elec. & Mfg. Co., Pittsburg, Pa.

Lamps, Incandescent

General Electric Co., New York.
Stanley Elec. Mfg. Co., Pittsfield, Mass.
Westinghouse Elec. & Mfg. Co., Pittsburg, Pa.

Lathe Attachments

American Tool Wks. Co., Cin., O.
Bradford Machine Tool Co., Cincinnati, O.
Niles-Bement-Pond Co., New York.
Osgood, J. L., Buffalo, N. Y.
Pratt & Whitney Co., Hartford, Conn.
Sloan & Chace Mfg. Co., Newark, N. J.

Lathe Dogs

Armstrong Bros. Tool Co., Chicago, Ill.
Billings & Spencer Co., Hartford, Conn.
Besly & Co., Chas. H., Chicago, Ill.
Le Count, Wm. G., So. Norwalk, Conn.
Pratt & Whitney Co., Hartford, Conn.
Tindel-Morris Co. Eddystone, Pa.

Lathes

Automatic Mach. Co., Greenfield, Mass.
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Bertram & Sons Co., Ltd., John, Dundas, Ont., Canada.
Blaisdell & Co., P., Worcester, Mass.
Blount Co., J. G., Everett, Mass.
Bradford Mach. Tool Co., Cin., O.
Bridgeford Machine Tool Works, Rochester, N. Y.
Bullard Mach. Tool Co., Bridgeport, Conn.
Davis Mach. Co., W. P., Rochester, N. Y.
Diamond Machine Co., Prov., R. I.
Draper Mach. Tool Co., Worcester, Mass.
Dreses Mach. Tool Co., Cincin., O.
Fairbanks Co., New York.
Flather & Co., Nashua, N. H.
Garvin Mach. Co., New York.
Gisholt Machine Co., Madison, Wis.
Greaves, Klusman & Co., Cin., O.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Lodge & Shipley Mach. Tool Co., Cincinnati, O.
McCabe, J. J., New York.
Marshall & Huschart Mchry. Co., Chicago, Ill.
Motch & Merryweather Co., Cleveland, O.
New Haven Mfg. Co., New Haven, Conn.
Niles-Bement-Pond Co., New York.
Osgood, J. L., Buffalo, N. Y.
Prentiss Tool & Supply Co., New York.
Robbins, L., Worcester, Mass.
Schumacher & Boye, Cincinnati, Ohio.

Lathes—*Continued*

Sebastian Lathe Co., Cincin., O.
Seneca Falls Mfg. Co., Seneca Falls, N. Y.
Shephard Lathe Co., Cincin., O.
Springfield Mch. Tool Co., Springfield, O.
Sutton Co., C. E., Toledo, O.
Vandyck Churchill Co., New York.
Von Wyck Mach. Tool Co., Cincinnati, O.

Lathes, Automatic Screw-Threading

Automatic Machine Co., Bridgeport, Conn.
Pratt & Whitney Co., Hartford, Conn.

Lathes, Bench

American Watch Tool Co., Waltham, Mass.
Blount Co., J. G., Everett, Mass.
Faneuil Watch Tool Co., Boston, Mass.
Pratt & Whitney Co., Hartford, Conn.
Sloan & Chace Mfg. Co., Newark, N. J.
Stark Tool Co., Waltham, Mass.
Waltham Watch Tool Co., Springfield, Mass.

Lathes, Boring

Niles-Bement-Pond Co., New York.

Lathes, Brass

Pratt & Whitney Co., Hartford, Conn.
Springfield Mch. Tool Co., Springfield, O.

Lathes, Wood

Seneca Falls Mfg. Co., Seneca Falls, N. Y.

Letters, Pattern

Butler, A. G., N. Y. City.

Lockers, Clothes

Merritt & Co., Philadelphia, Pa.

Lubricants

Besly & Co., Chas. H., Chicago, Ill.
Dixon Crucible Co., Jos., Jersey City, N. J.

Lubricators

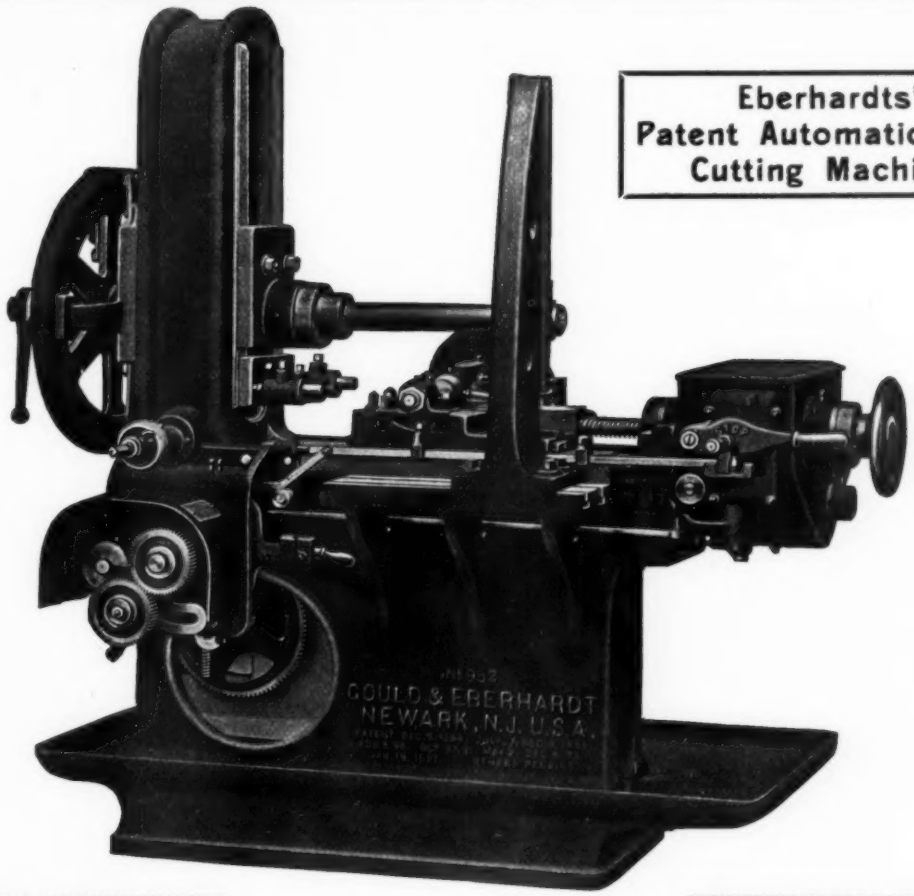
Besly & Co., Chas. H., Chicago, Ill.
Lunkenheimer Co., Cincinnati, O.

Machinery Dealers

Baird Machy. Co., Pittsburg, Pa.
Chandler & Farquhar, Boston, Mass.
Durbrow & Hearne Co., New York.
Fairbanks Co., New York.
Garvin Mch. Co., New York.
Godfrey, A. W., Boston, Mass.
Hill, Clarke & Co., Boston, Mass.
McCabe, J. J., New York.
McDowell, Stocker & Co., Chicago, Ill.
Marshall & Huschart Mchry. Co., Chicago, Ill.
Motch & Merryweather Co., Cleveland, O.
Niles-Bement-Pond Co., New York.
Pattison Machinery Co., W. M., Cleveland, O.
Prentiss Tool & Supply Co., New York.
Toomey, Frank, Philadelphia, Pa.
Tuohy Bros., New York.
Vandyck Churchill Co., New York.
Wormer Mchy. Co., C. C., Detroit, Mich.

Machinists' Small Tools

Athol Mach. Co., Athol, Mass.
Bemis & Call Hardware & Tool Co., Springfield, Mass.
Besly & Co., Chas. H., Chicago, Ill.
Billings & Spencer Co., Hartford, Conn.
Boker & Co., Hermann, New York.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Twist Drill Co., Cleveland, O.
Davis Co., Frank M., Milwaukee, Wis.
Durbrow & Hearne Mfg. Co., New York.
Hammacher, Schlemmer & Co., New York.
Patterson, Gottfried & Hunter, Ltd., New York.
Pratt & Whitney Co., Hartford, Conn.
Sawyer Tool Mfg. Co., Fitchburg, Mass.
Slocomb Co., J. T., Prov., R. I.
Standard Tool Co., Cleveland, O.
Starrett Co., L. S., Athol, Mass.
Syracuse Twist Drill Co., Syracuse, N. Y.



Eberhardts' Patent Automatic Gear Cutting Machine.

Automatic In One Operation.

After setting, our NEW TYPE AUTOMATIC GEAR CUTTING MACHINE requires no attention until the gear is finished. Turns out spur gearing rapidly and with an accuracy unparalleled—quantities or otherwise.

Though it is the very acme of simplicity, it embodies more real mechanical conveniences than any other gear cutter yet produced. Accurate worm dividing wheel, made in sections; powerful screw feed to cutter slide; cutter spindle driven by powerful, smooth-running worm and worm wheel; movable outside support to work arbor; patent oil pan base.

We make machines for Spur Gears only, from 12 inches to 12 feet; for Spur, Bevel, Skew and Face Gears, from 22 to 74 inches.

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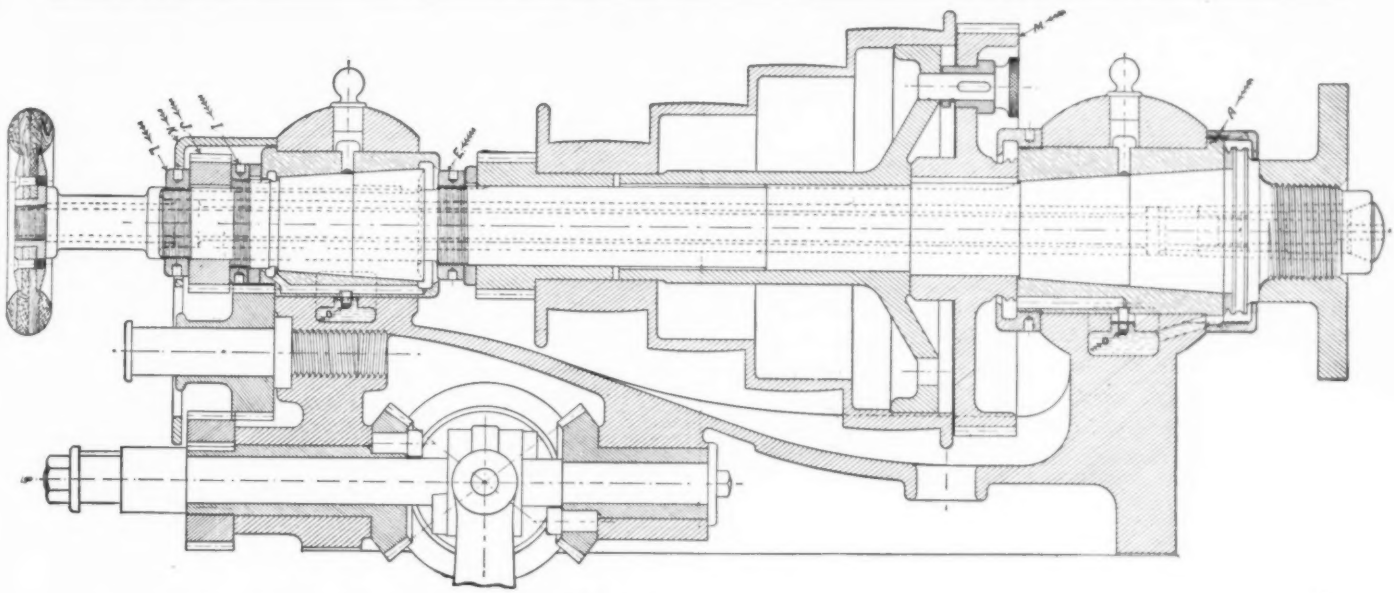

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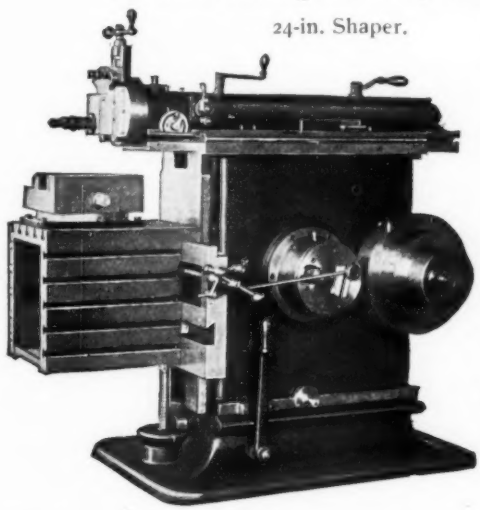

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The Attachment of Motors to Machine Tools.

EDITORIAL CORRESPONDENCE.

Sufficient experience has now accumulated in attaching motors to machine tools, both new and old, to enable some useful lessons to be drawn therefrom. As the readers of the AMERICAN MACHINIST are aware, the Crocker-Wheeler Company early took a leading position in this matter and the experience of the company covers not only a long period of time but

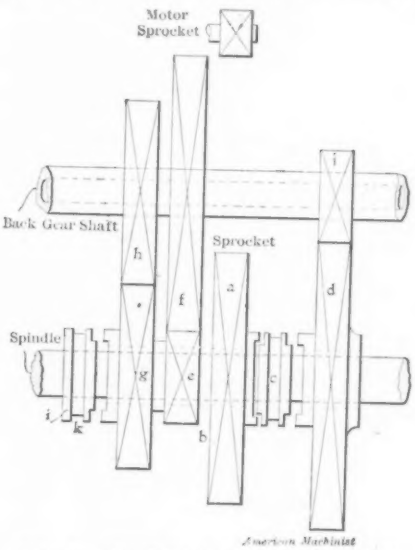


FIG. 1. THREE-RUN EQUIPMENT, NEW THROUGHOUT.

a wide range of applications. Thru their liberality the accompanying illustrations of their methods are given. These methods have now been reduced to a common and fairly systematic line of procedure, so far as general method is concerned, this procedure being applied to old and new tools alike, and the illustrations to be given will be drawn from both classes of work. There is no doubt that the supposed difficulty of connecting the tools already installed has been a powerful influence in deterring shop managers from adopting electric driving in new equipment, and from this standpoint the methods to be given will be found particularly useful.

The starting point in applying an individual motor is, of course, the proper speeds and the proper speed range. The methods used contemplate the use of the multiple-voltage system with which the Crocker-Wheeler name is identified, but they are equally applicable to other systems of motor control provided the required speed range is obtainable.

THE GENERAL METHOD.

The general method is to use the range of speeds given by the motor in combination with gear changes, a new gear combination being thrown in when the motor range is exhausted, the motor range being then again gone thru and this process repeated until the required total range is covered. In carrying out the plan it is sometimes necessary to alter the back gears upon the tool to be driven and sometimes not. The retention of the existing gears sometimes involves an overlapping of the speeds and it sometimes leads to a gap. While the former arrangement is not ideal it is not objectionable. The latter is of course objectionable if the gap is a wide one, and is of itself of sufficient importance to call for new gears. When changes are required they are seldom a serious matter as regards cost.

Most of the plans to follow involve the use of silent chains in place of belts, and this of course provides an opportunity for increasing the power of the drive in order to make use of high-speed steel, and it is the possibility of thus powering up existing tools that frequently leads to their being converted.

The number of gear combinations in any case is determined by the number of times that it is necessary to repeat the motor range in order to get the total range required. The number of combinations will thus vary in any given case with the range of the motor to be used. With the Crocker-Wheeler system this range is usually 3 to 1. Without a gap in the speeds when the gears are changed the use of the motor range twice gives a total speed ratio of $3^2 = 9$, three times gives $3^3 = 27$, and four times gives $3^4 = 81$. There is, however, no reason for avoiding a gap at these points provided it is not too large. If the first speed with the second combination differs from the last one by the first combination by the ratio that exists between successive motor speeds, the series of speeds is unbroken, whereas without such a gap the first speed of the second combination would duplicate the last one with the first combination.

In determining the total range obtainable with a given number of repetitions of the motor range we therefore add the interval between successive motor speeds, usually 15 per cent., to the motor ratio. This addition does not, however, apply to the last combination for which we have only the motor range and we thus obtain for the total range for

Two motor ranges..... $3.15 \times 3 = 9.45$
Three " " ..... $3.15^2 \times 3 = 29.76$
Four " " ..... $3.15^3 \times 3 = 93.75$

The square root of 10 being 3.16, it follows that an existing back gear of this ratio will fit in well with another gear combination of 3.16 to 1 and a motor range of 3 to 1 and give a total range of practically 30 to 1, the intervals being all 15 per cent. as provided for the motor, except that at the gear changes this will be increased to 16 per cent., a difference that is negligible.

If the back-gear ratio exceeds 10, the interval as the gears are thrown in will be increased or the motor range must be increased, or the back gears must be altered, and the judgment of the designer must decide which will be done.

In special cases there are, however, other alternatives. With small ratios of back gearing if the power required is not great in proportion to the size and value of the tool, and if, as is often the case, the original speed range is not all required, it may be advisable to make a large increase in the motor range and make no change in the gearing. Thus with a back-gear ratio of 6 to 1 giving a total range of $6 \times 4 = 24$ a motor range of 4.5 to 1 may be used giving a range with the gears of $6 \times 4.5 = 27$. The cone pulley speed range is usually 4 to 1 where the back-gear ratio is 6 to 1. Thus a 4.5 to 1 motor gives a greater total range and smaller gap. This plan is especially useful for small tools with which quick speed changes are very desirable.

With machines requiring infrequent changes of speed, as, for example, large boring mills, it is usually better to reduce the motor range to, say, 2 to 1 and introduce another pair of gears. With a back-gear

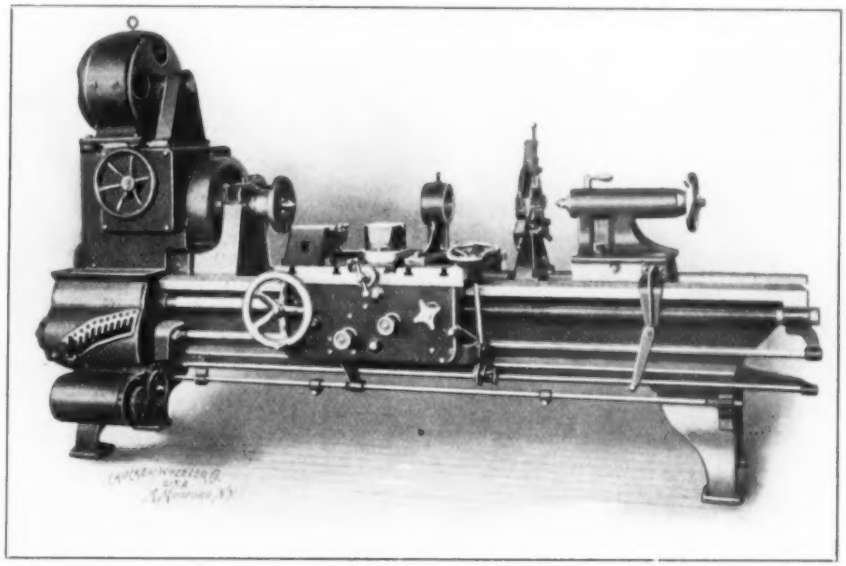


FIG. 2. HENDEY-NORTON LATHE—ILLUSTRATING THE SCHEME OF FIG. 1.

ratio of 6 to 1 the added gears would have a ratio of $\sqrt{6} = 2.45$, giving a gap ratio as the gears are thrown of $\frac{2.45}{2} = 1.225$, or an increase of speed of 22½ per cent., which is not excessive. The total speed range obtained is of course $2.45 \times 2.45 \times 2 = 12$ to 1.

Usually, however, conditions are such, due to the fact that less metal is removed per minute on the extreme diameters and that the power absorbed by the tool itself decreases with the speed, that on the low back-gear run it is possible to use still lower motor speeds and yet have sufficient power in the motor. That is, on this run the motor may be used thru a 4 to 1 range and thus obtain a total range of $2.45 \times 2.45 \times 4 = 24$ to 1.

THREE-RUN EQUIPMENTS.

A schematic representation of a three-combination gear applied to a lathe is shown in Fig. 1. The sprocket to which the motor is connected by a silent chain is shown at *a*. It is mounted on a quill *b* and clutch *c* serves to connect it or the gear *d* to the spindle. Quill *b* carries gear *e* meshing with *f* and a second quill carries gear *g* meshing with *h*, and by clutch *i* may be connected to the spindle. The first or direct motor range is obtained by throwing clutch *c* to the left, *i* being open. The second is obtained with *c* in its middle position and *i* closed, the motion being carried thru *a*, *b*, *e*, *f*, *h*, *g*, *i* to the spindle, and the last with *c* thrown to the right and *i* open, the motion being carried thru *a*, *b*, *e*, *f*, *j*, *d*, *c* to the spindle. It is obvious that were clutches *c* and *i* both engaged at the same time a smash-up would follow and hence these clutches must be interlocked.

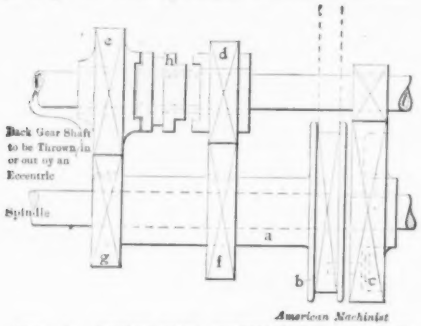


FIG. 4. THREE-RUN EQUIPMENT, PARTLY NEW AND PARTLY OLD.

An example of the use of this arrangement is shown in Fig. 2, which represents an original construction and not a conversion. The method of manipulating the clutches in this case is by the hand-wheel in front of the headstock, the connection of this to the clutch levers being by a cam shown in three positions in Fig. 3. The clutch levers are pivoted at *a* and *b*, the right-angle arms projecting from them and carrying the cam rollers. Notches in the edge of the cam with a spring latch, shown in the right-hand view only, locate the three positions which are in the order of the speeds—turning the hand-wheel in one direction giving in succession the three gear runs. The ratio of each gear is approximately 2¾ times that of the previous one and the motor ratio 2.4 to 1. The controller is attached to the shears below the feed gear box and the motor speeds are obtained by the hand-wheel on the apron. The motor is of 5 horse-power and the speed range from 9 to 340 revolutions per minute in 23 steps.

When converting lathes the scheme of Fig. 1 is commonly used when the old back gear ratios are found to be inadmissible, and hence new gears throughout are found to be necessary. Fig. 4 shows a method of retaining the gears at the face-plate end of the spindle and the back-gear quill and quill mounting.

In this arrangement the cone pulley is replaced by a quill *a* carrying the sprocket *b* with which the back gear latch pin *c* engages as it previously did with the cone pulley. The eccentric shaft for throwing the back gear into and out of mesh is retained and the back gear quill has mounted loosely upon it two gears *d*, *e* meshing with gears *f*, *g* on the sprocket quill, a clutch *h* being splined to the quill between gears *d* and *e*. Interlocking arrangements to prevent mal-adjustment of the levers are not commonly used with this arrangement, as it is so similar to the traditional cone pulley and back gear with which everybody is familiar that mistake is scarcely possible. The clutch *h* can of course engage but one gear at a time, and the only precaution necessary is to have the back gears out of mesh or the clutch in its central position when the latch pin engages the sprocket quill as with belt driven lathes.

ALTERED LATHES AND MILLING MACHINES.

Examples of this construction are shown in Figs. 5, 6 and 7, of which Fig. 5 shows a Lodge & Shipley standard lathe. The motor stand is attached to the standard headstock. The main sprocket is mounted on the spindle sleeve, as sketched in Fig. 4, and the changing of the back gears is done by the short lever shown in front of the motor stand. In this case, however, there is no clutch, but instead a sliding gear operated by this lever, of which the central latch-pin hole locates the gear in the mid or disengaged position. This lever and the back-gear latch pin are not interlocked. The speeds obtainable at full power range from 12 to 450 revolutions per minute in 21 steps. For setting up work or for taking light cuts speeds down to 4 revolutions per minute can be obtained. The motor speeds are obtained from the apron as in Fig. 2. The motor is of 3 horse-power.

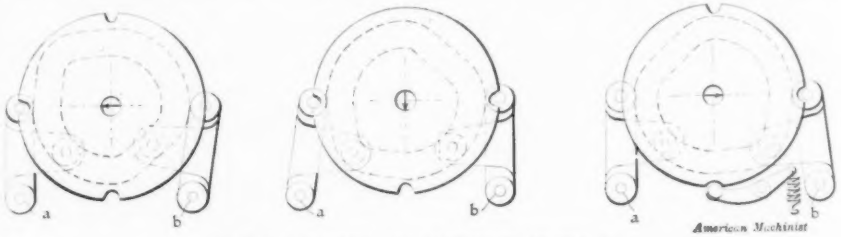


FIG. 3. CLUTCH ARRANGEMENT OF FIG. 2.

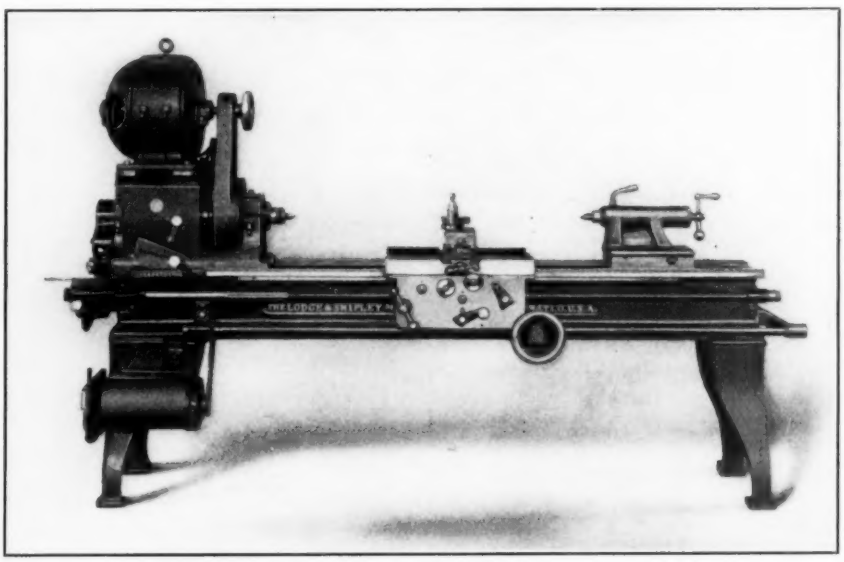


FIG. 5. LODGE & SHIPLEY LATHE—ILLUSTRATING THE SCHEME OF FIG. 4.

Fig. 6 shows a 34-inch Putnam lathe, which, while driven on the plan of Fig. 4, nevertheless had all its gears changed, as the original gearing could not be used satisfactorily. New gears were therefore substituted for the old, the ratio being 10.5 to 1, the second set having a ratio of 3.2 to 1. The clutch arrangement in this case is

exactly the same as that shown in Fig. 4, the clutch being operated by a lever, of which the handle is shown in front of the motor stand.

In this, as in the previous case, the eccentric shaft of the back gears was retained, permitting the gears to be thrown entirely out of mesh when running direct. The available speeds range from 255 to 2 in 44 steps, speeds from 5 to 2 being used only for light cuts or for chucking. The motor is of 10 horse-power.

Fig. 7 is a Cincinnati milling machine in which the drive is strictly in accordance with Fig. 4, except that no clutch is used, the gear changes being made by sliding the gears on the back-gear quill—a hand-wheel being placed on the motor shaft to facilitate bringing the gears into position for slipping into mesh. The effective speed range is from 340 to 9 revolutions per minute in 20 steps, with additional speeds down to 3 revolutions per minute for use with light cuts. The motor is of 7½ horse-power.

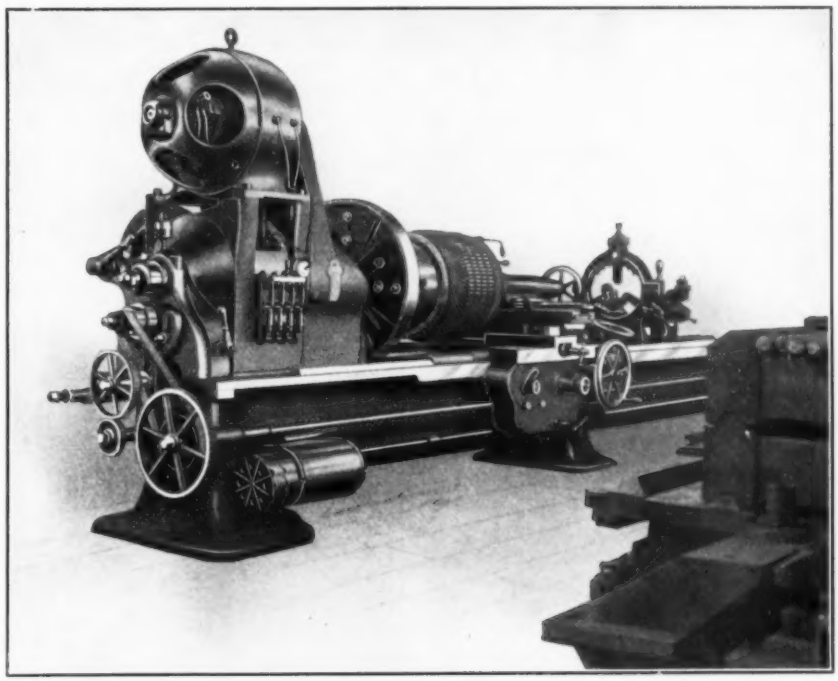


FIG. 6. PUTNAM LATHE—ILLUSTRATING THE SCHEME OF FIG. 4.

FOUR-RUN EQUIPMENTS.

A four-combination gear is shown in Fig. 8, the sprocket *a* being attached to a sleeve which carries gear *b* meshing with *c*. A clutch *d* engages either *b* or *j* with the shaft, and a clutch *g* engages either gear *f* or *i* to the spindle. The various combinations are as follows: *a b c k j d h i g* to spindle; *a b c k j d h i g* to spindle; *a b d e f g* to spindle, and *a b d h i g* to spindle.

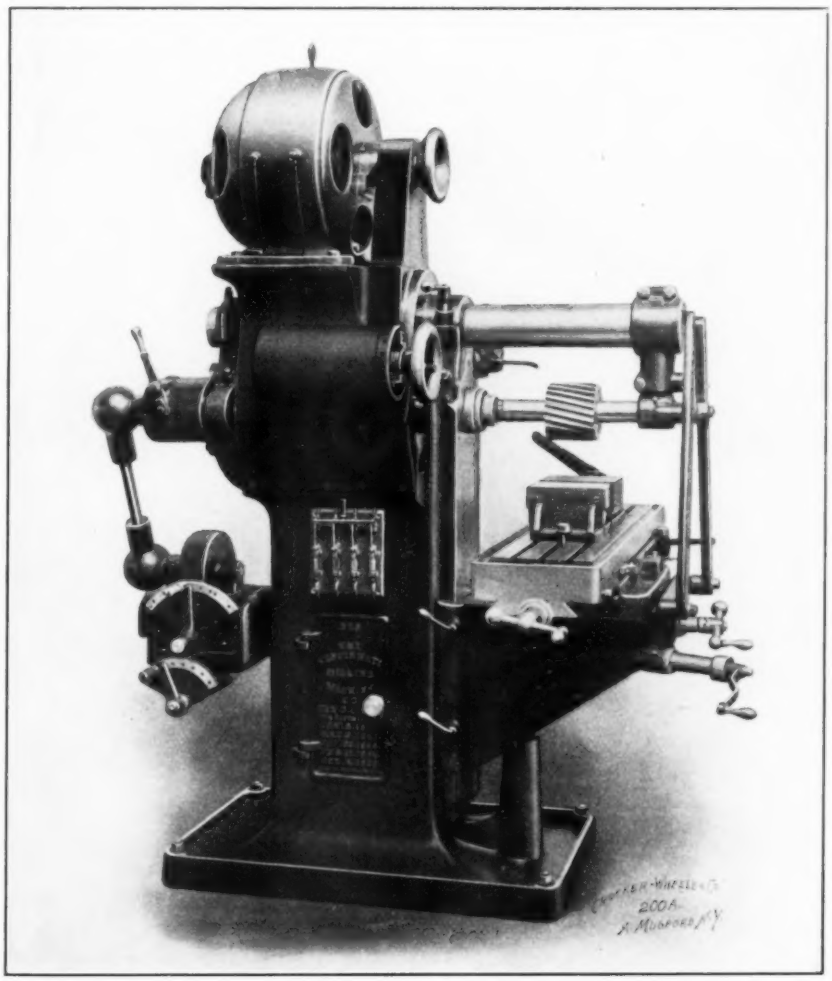


FIG. 7. CINCINNATI MILLING MACHINE—ILLUSTRATING THE SCHEME OF FIG. 4.

Interlocking with this arrangement is not necessary, as it is not possible for the clutches to clash. It is, however, desirable to have the clutches manipulated by a hand-wheel, and this may be effected by the cam arrangement sketched in Fig. 9, the cams being shown in the four positions which succeed one another in the order of the letters attached. In position *A* clutches *d* and g are both at the right, as shown in Fig. 8; in position *B*, *d* remains at the right, but *g* has been thrown to the left; in position *C*, *d* has

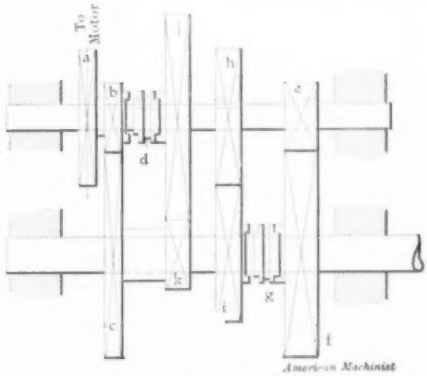


FIG. 8. FOUR-RUN EQUIPMENT.

been thrown to the left and *g* to the right, and in position *D*, *d* remains at the left while *g* has also been thrown to the left. These movements are obtained by a crank handle and latch pin shown below in Fig. 9, the various positions of the crank giving the gear combinations in regular speed order.

Stop pins *a b* in the lower view of Fig. 9 make it impossible to make an abrupt change from the slowest to the fastest speeds and *vice versa*.

AN ALTERED BORING MACHINE.

This construction is a very flexible one, as gears may be added to or taken from it as desired. An application of it is shown in Fig. 10, which is a Newark horizontal spindle boring machine. In this case, however, the clutch *g* of Fig. 8 is replaced by a pair of sliding gears splined to the upper shaft.

Fig. 11 illustrates the method by which the motor stand and back-gear shaft support were added to this machine. The speeds range from 250 to 7 revolutions per minute, or to 3 for light cuts. The motor is of 4 horse-power.

Fig. 12 illustrates a Rogers & Hemphill 40-inch boring mill which is driven essentially upon the plan of Fig. 8, except that but three gear combinations are used and the clutches are on the upper shaft, the gears on the lower shaft being all keyed to

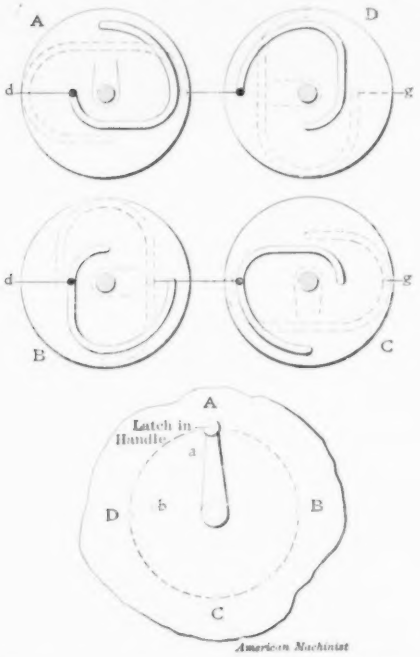


FIG. 9. CAM AND DIAL FOR OPERATING COMBINATION SHOWN IN FIG. 8.

a quill which has the same function as the cone-pulley quill of an ordinary lathe headstock. As originally designed, the machine was intended for a constant speed motor, the three pairs of gears in addition to a back gear giving six speeds. A variable speed motor was applied to it in order to introduce intermediate speeds and to obtain increased ease of speed change. A variable speed motor is always larger than a constant speed machine of the same horse-power, and this necessitated a larger shelf for the motor and new gears between the motor and upper shaft, but otherwise the gears were satisfactory and remained unchanged. There are two clutches, the one nearest the observer being double and controlling two pairs of gears, while the further one is single and controls a single pair of gears. The clutches are operated by the pull handles near the controller, and with the arrangement used it is evident that they must be interlocked, the method used being shown in Fig. 13.

Bar *a* operates the single clutch and bar *b* the double clutch, and it is necessary to so interlock them that neither can be moved to the engaged position unless the other is in the disengaged position. Locking pin *c* has wedge-shaped ends corresponding to notches in bars *a* and *b*. In the position shown it is obviously impossible to move bar *b* until bar *a* has its notch brought below the pin, and if thus located and *b* is moved *a* will in turn be locked in position. Latch pins *d e* have springs behind them to enter recesses in the bars and thus indicate when they are in the disengaged position. In the position shown pin *d* enters its recess while the recess for *e* is at *f*.

In this case all but the very heaviest work at maximum diameter can be handled without using the back gears and therefore the operator can make all needed speed changes from the front of the machine.

AN ALTERED GUN LATHE.

Fig. 14 shows a very successful piece of rearrangement, the machine shown being the great Sellers 16-inch gun lathe at the Washington Navy Yard. The reader will understand that in this case the designation "16-inch" refers to the size of the gun for which the lathe was designed.

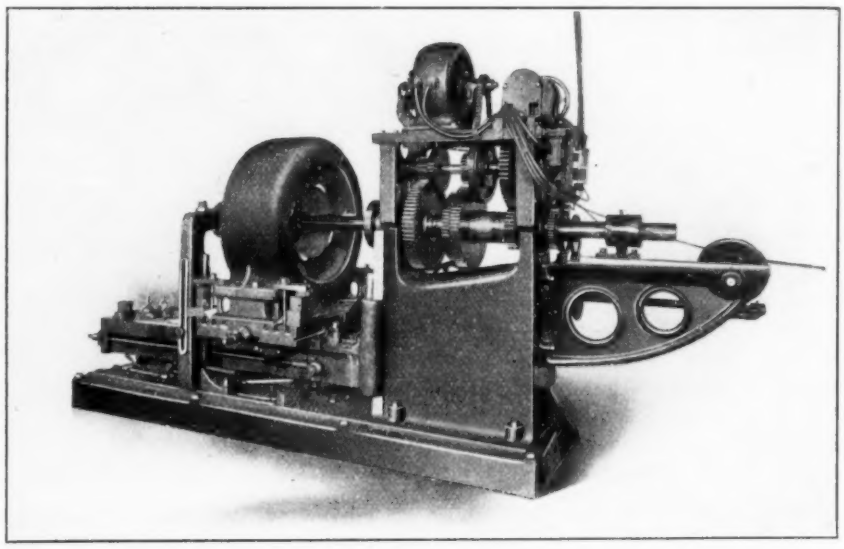


FIG. 10. NEWARK HORIZONTAL SPINDLE BORING MACHINE—ILLUSTRATING THE SCHEME OF FIG. 8.

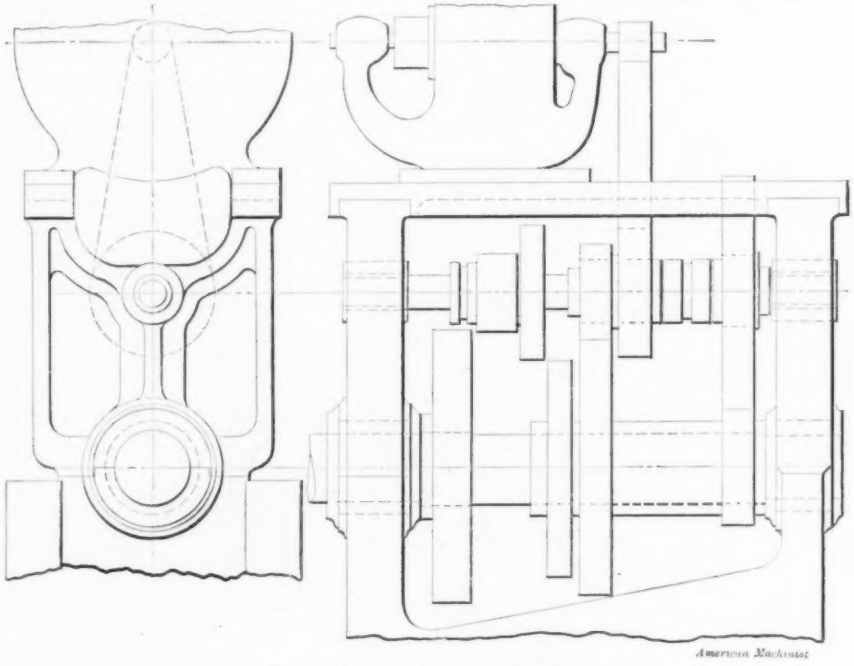


FIG. 11. MOTOR AND GEAR STAND OF FIG. 10.

Fig. 15 shows a sectional elevation of the headstock with the cone pulley in position as originally made. So large a lathe was of course always back geared and, in fact, double back geared, the drive being thru pinion *a*, gear *b*, pinion *c*, gear *d*, pinion *e* to face-plate; gear *d* and pinion *e* being

upon the shaft which carries the cone pulley.

A glance at the proportions of the cone pulley will show that it gave a speed range entirely beyond anything permissible by motor speed variation and the motor range is therefore doubled by a back gear between the motor and the first gear of the original construction.

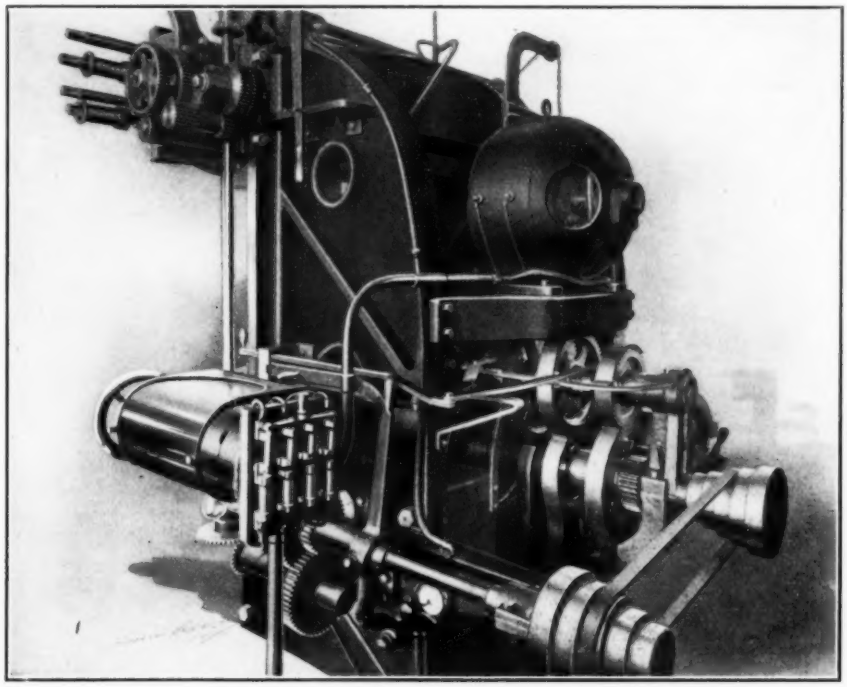


FIG. 12. ROGERS & HEMPHILL BORING MILL—ILLUSTRATING THE SCHEME OF FIG. 8.

These back gears are shown very clearly in Fig. 14 on and below the motor shaft. As with the cone pulley the motor does not drive the shaft on which it is mounted, but the pinion immediately at its left. With the clutch engaging this gear the motion is direct to the pinion at the extreme left but with the clutch thrown to the left and engaged with the large gear at the left and the back gear thrown in by the eccentric handle projecting near the hub of the lower right-hand gear, the motion is down thru these gtars and up to the large gear above. The rapid traverse for the carriages, which was originally belt driven, is now obtained from a special motor at the left of the lathe on the floor.

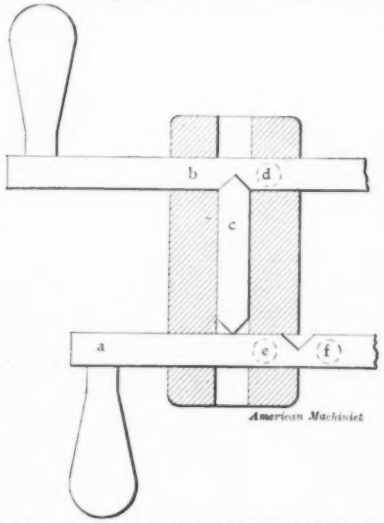


FIG. 13. INTERLOCKING ARRANGEMENT OF FIG. 12.

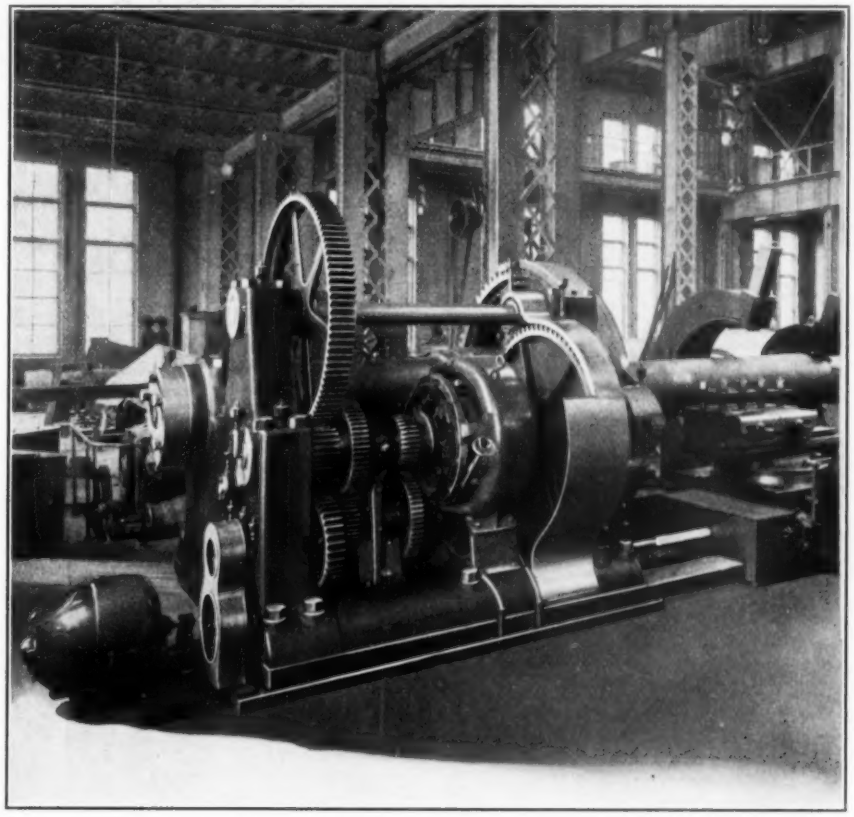


FIG. 14. REPOWERED SELLERS GUN LATHE.

The entire construction will be seen to be extremely neat, the fact that the lathe was not originally built in its present form being scarcely noticeable.

AN ALTERED PLANER.

Fig. 16 shows a method of connecting a 48-inch widened pattern Cincinnati planer, which in its general arrangement is self-explanatory. The motor is of 10 horse-power and compound wound. It operates on the four-wire system and gives a range of cutting speeds from 10 to 35 feet a minute in 10 steps. The flange on the motor shaft pulley is for flywheel effect. The construction, while very simple, is entirely satisfactory. F. A. H.

Summer School of the State College of Kentucky.

The State College at Lexington, Ky., announces a summer school in mechanic arts, to begin June 8 and end August 15. The work offered comprises mathematics and English, steam engineering, applied electricity, machine design, materials of construction, transmission of power and shop work. A uniform fee of $25 will be charged. Up to the capacity of the college dormitories, room rent will be free of cost. Rates for boarding range from $2 to $3.50 per week. There will be no entrance examinations.

The Santa Fe railroad system buys a ton and a half of pins a year, six and a half tons of rubber bands, twenty-five miles of lead pencils, fifty barrels of ink and a third of a million of steel pens.

Echoes From the Oil Country — A Round Peg in a Square Hole.

It was the noon hour and they were sitting around the fire talking about the new man who had come to work a few days before.

This was a job shop; one of the kind where a man is supposed to do anything that is handed to him. The youngest "cub" in the place knew that it was a first-class place to make mechanics, and Jackie, who had been here for more than a year, felt that he was much the superior of the man who had learned all that he knew of machine shop practise in a manufacturing establishment. Hadn't he heard it long before he got a chance to work that "it is no use trying to learn a trade in a manufacturing shop—a job shop is the only place"? Besides that, didn't he know Tommy Smith, who had been running a drill press for six years, and Bob Brown, who was on the bolt cutter in the same shop, and had been on it for longer than he could remember?

Jackie may have felt just a little stuck up about the superiority of the job-shop man, at least he used to wonder how the manufacturing shop managed to make machinery that they could find a market for with such workmen as he imagined they had.

One of the men told how the new man had been given a set of pump castings with the orders to "fit them up for that engine there, and make the plunger an inch and a half," and the men roared with delight as he tried to describe the look on the foreman's face when the man asked him where he would find the blueprints. When the foreman recovered he had explained things a little something after this fashion. (These small pumps are fastened on to the bed of the engine. The plunger is attached to the crosshead. They are used to feed the boiler.) "You see now, she fastens on to the bed here with these two screws, and the blacksmith will cut you off a piece of one and three quarters as soon as you give him the length. One and five-eighths would be big enough, but we haven't any of it on hand. The fine work is to see that she lines up right, and now go right after it, for they will be in after the engine some time to-morrow."

It was not so much because he was telling anything new to them that the men laughed at the attempted personification, but because it brought to mind again the

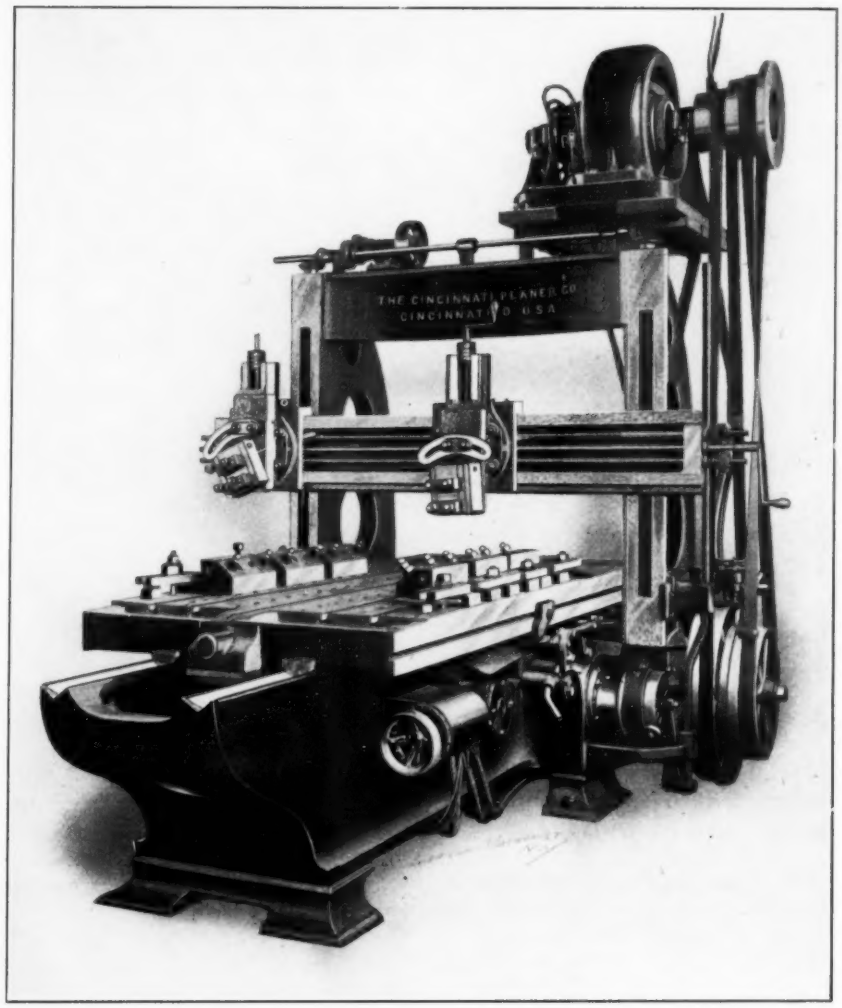


FIG. 16. A CONVERTED CINCINNATI PLANER.

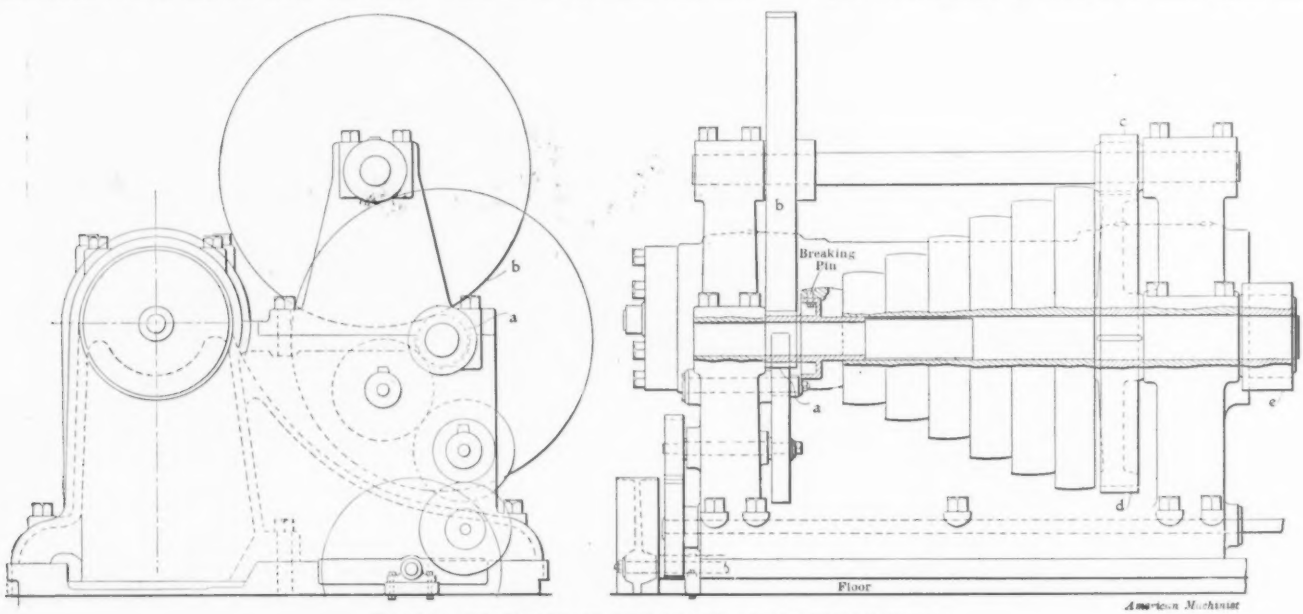


FIG. 15. HEADSTOCK OF GUN LATHE AS ORIGINALLY BUILT.

things which many of them had seen. Born and raised among the machinery they were used to repairing, it did not strike them that much of their expertness came from being able to know just what the customer expected.

"He made a pretty good guess what size to make the gland," said old Toby, still discussing the new man, "but he didn't have any notion as to how to go about it to line her up. He was a going to stretch a line thru the hole in the crosshead arm to work to till I told him he better make his plunger first."

"Didn't he know that much?" broke in Jackie. "If I thought this cub didn't know more than that I would just tie a stone on him and drop him into the creek," and he gave the cub a friendly kick just to show his interest.

"Maybe you won't believe me," said Toby, with the air of a man who knows his statement is likely to test the credulity of his hearers, "but he didn't know how to get the length of his plunger, and when I told him to make it anywhere within two inches either way of two foot ten he really thought that I was just joking him."

"Where did he come from, anyhow?" asked Sam, as he began to pack his empty dishes back into his dinner pail.

"I asked him that very thing," said Toby, "and he told me he was from Providence, Rhode Island. He said that he had learned his trade in a tool shop, but had an idea that he could do better in the West, and so had struck out for himself. He seems to be a nice enough fellow and don't swell up whenever someone tells him anything, and I feel sort of sorry for him."

The general sentiment of the men toward the new comer seemed to be decidedly friendly, even if they did make sport of his lack of knowledge of machine-shop work as seen by them, and there was at least one man who, even if he could not say anything favorable for the new comer, at least showed that he did not have as high an opinion of some of the others as they had of themselves.

This man had wandered in one day, very much out at the heel, and asked for a job. On being asked what he could do he had replied, "Fetch on anything you want to, and if I can't do it kick me out." The foreman had taken him at his word, but had not as yet been able to find the job that stuck Mike. The boys nicknamed him "Gloomy Gus," partly because of his sarcastically expressed opinions, and partly because of his unkempt appearance, but for all that he was looked up to as a mechanical authority because of his ability to handle any job that came along.

Many of these jobs must have been new to him, but he never seemed to be at a loss for a way to do them. He had ways of his own for doing many of them. This did not surprise them, as every man was free to use his own methods as long as the results and the time taken were satisfactory to the foreman, but it did surprise them to see that some of these methods were such as had never been seen by any of them. These new methods were generally improvements over the ones in common use.

It was Mike who stepped in between the new comer and the others. "Some of you fellows think you are awful smart mechanics. You have just learned a few things around home here, like a dog learns tricks, and think you know it all. If you happened to get away from home here you would be lost. More than likely if any of you got into the shop where he learned his trade, or at least served his time, you would know a mighty sight less than he does here. There is not one of you here that is knee high to a hop-toad in the mechanical line."

"Say, Toby," called Jackie, who was always ready for anything that promised a little excitement, "put that in your pipe and smoke it, will you. Gloomy says you're nothing but a mechanical hop-toad. Being as he's Irish it is easy to see what he thinks of you. I knew that the truth would come out on you some time." The laugh seemed to be on Toby.

"If you ever get to be anything more," retorted he, "it will be because we pound it into you, and not because you ever put your mind to learning anything. You little ignoramus, you couldn't tell in a week how many sixty-fourths is in an inch and three-eighths."

This hit Jackie on a tender spot, for he had lately spoiled a job because he did not correctly add sixty-fourths and eighths together.

Ben King, the new man, came walking up to the gathering.

"How are you getting along with the pump?" asked one of the men.

"Not very well," replied Benjamin. "You see, all of this work is so horribly rough that I am always trying to do it too good. Where I came from the work must be done right or it will not pass the inspector, and I want to tell you right here that you didn't want to have him send work back to you very often or you got into trouble. Here the only thing seems to be to throw it out quick. No matter how it is done, just get rid of it. The fellows at home wouldn't believe me if I told them how things are done here and how one is expected to do work without any proper facilities. No drawings, no blueprints, no gages, no cutting-off machines. Every man having to do his own drilling. Not a turret lathe or a milling machine in the place. No standards of any kind. Anything will do if it will go together and be loose enough. One real good fit on a job is enough to spoil it." (He knew that from experience, as one of his good fits had seized and made trouble.) "Any kind of a job is handed out by the foreman without any kind of instruction, and when he comes around he does not tell how he wants it done, but he says, 'You'll have to get more of a move on than that. Any of the other men would have had it done long ago.' It don't seem to do a bit of good to ask him how he wants it done, or to call his attention to how well I am doing it. Now, where I came from the blueprints show how a thing is to be. By the sizes are marks that show how close it has to be. Where it is to be finished the marks tell what kind of a finish is wanted. The toolroom furnishes all of the gages to use on the job. A card comes with the work, and it shows what to do first and what speed to run and what feed to use, and the right kind of a tool to use. The card tells how long it takes to do each operation on the job, and if you can't do it that quick you go after the speed boss and he comes and shows you how to do it. If the card isn't right for that lathe, it is part of his business to have the card fixed. With a proper kind of system I can get out as much and as good work as anyone."

Jackie seemed to be deeply interested. "Who fixes the machines when they break down?" he asked.

"A man from the toolroom has to do that," Benjamin replied. "They have to do all of the tool grinding in the toolroom. There is a Sellers tool grinder that cost more than any machine in this shop, and the man that runs it has a chart that shows him how to grind every tool so that they are always alike. A boy has to do the running for you, and it is part of the business of one of the foremen to see that the work is brought to the machines so as not to let them stand, and he has it taken away when it is finished."

"You fellows do a lot of thinking while you are doing a little rough work so that it will do what you are planning it should. Where Ben came from, the owners have it fixed so that he could do a whole lot of good work without thinking," said Mike, as he got up to begin the afternoon's work. "I know all about it, for I have been there." W. OSBORNE.

A Machine for Breaking Rails.

At the works of the Danville Structural Tool Company, Danville, Pa., there is a machine for breaking rails, which was designed as a substitute for a shearing machine, the advantage being that it will break rails into pieces of accurate length about twice as fast as they can be sheared. The machine is arranged on a horizontal bed with a flywheel of heavy construction, and weighs 15,000 pounds. It is electrically driven, the gearing running continuously. There is a plunger making twelve to fifteen strokes per minute. Normally this plunger works idly at the rear of a plunger head, which remains stationary until a long wedge is inserted between the two, when the plunger head is moved forward to strike the rail at mid span of two supports. When the rails are not to be broken to exact length the wedge remains inserted and the plunger works continuously.

The Works of the Ateliers de Construction Oerlikon, at Oerlikon, Switzerland.

BY EMILE GUARINI.

The Ateliers de Construction Oerlikon, of which some views are given herewith, hold a very important position in the Swiss industrial world, and the engines which they construct have been applied to the most varied uses throughout the world. They may be cited as one of the best known firms in the electro-technical industry. The workshops of the Société Oerlikon, the actual capital of which amounts to about twelve millions, occupy a superficial area of 13 acres, of which 47,000 square meters are covered with buildings; the number of workmen employed is no less than 1900, and their annual salaries amount to several million francs.

An idea of the influence exerted by this firm may be obtained by comparing these figures with that of the population of the village of Oerlikon, which, about thirty years ago, only amounted to about 800 souls, whereas at the present time it is nearly 15,000. This extremely rapid development is due to the creation in 1872 of the firm of Oerlikon, which has sprung from its original position as a humble private firm into the ranks of leading houses, and enjoys a world-wide reputation thanks to the gradual improvements introduced into the sphere of their activity.

The control and management is attended to by three technical offices, each devoted to a special branch. One office prepares the orders for execution, and controls the process of manufacture in general; a second superintends the plant and keeps everything in a good state of working order; finally a third and special office controls the foreign agencies and the operations of the branch offices which assist in the sale and placing of the products made by the head establishment. The management also comprises departments for inspection, business offices, etc.

The total power of the machinery erected by the company exceeds 300,000 horse-power, distributed notably among the numerous central stations to be found not only in Switzerland, but also in France, Russia, Spain, Mexico, Germany, Austria, and Sweden. In London 20,000 horse-power are used in connection with electric lighting plant; some electro-chemical works use 40,000 horse-power, and thirty lines of railway owe their origin to the Oerlikon firm, who have constructed more than 23,000 dynamos and transformers, 17,000 mills, 6,600 machine tools, and several hundred thousand fuses for shrapnel. Every year they work up 3,000,000 kilograms of foundry pig, 500,000 kilograms of cast steel, 110,000 kilograms of gun metal, etc.

The system of tactics adopted by the Oerlikon firm in taking up the construction of the very latest types of mechanism has resulted in their adoption of very varied fields of activity, covering machine tools, bolting mills, roller mills, disintegrators, gray-iron cylinder burnishing and fluting engines, and similar apparatus for fluting and polishing porcelain cylinders, shrapnel, of which they make an enormous quantity, also making the machinery required for their manufacture. They also construct apparatus for making fuses and for shaping the wooden stocks of fire-arms, etc., etc.

In the field of electro-technics their field of operations embraces all the branches of this varied industry, including continuous, alternating, monophase or multiphase generators and motors, tramway motors, portable motors, transformers, etc. They fit machine tools of all kinds with mechanism for driving in groups or separately, and also looms, pumps, ventilators, centrifugal apparatus, lifts, winches, cranes, endless screw transmissions, and weir gates.

I have already referred to the railways whose origin is due to this firm; they are both of the normal and narrow gage type. They have also built several locomotives for use in mines.

Finally, they have also erected numerous electro-chemical and electro-metallurgical installations for bleaching, welding, the extraction of aluminum, the manufacture of carbide, etc.

FIG. I. GENERAL VIEW OF THE OERLIKON WORKS.

Everything possible has been done to insure the physical, moral and intellectual well-being and comfort of the workmen. The solicitude of the managers and directors has gone so far as to construct a casino with a garden and a cheap restaurant; they have also built cheap baths and comfortable workmen's dwellings. Special facilities are provided for apprentices, so as to afford them every facility for developing their education. A pension fund is now being formed, and there is already a fund for giving assistance to those needing it. A committee has also been appointed for maintaining personal contact between the various elements forming the hierarchy of this vast establishment.

As regards the hygienic condition of the various workshops, everything has been done to render it faultless, thanks to an abundance of light, excellent ventilation, and the removal of all dust, especially in

FIG. 2. FOUNDRY INTERIOR.

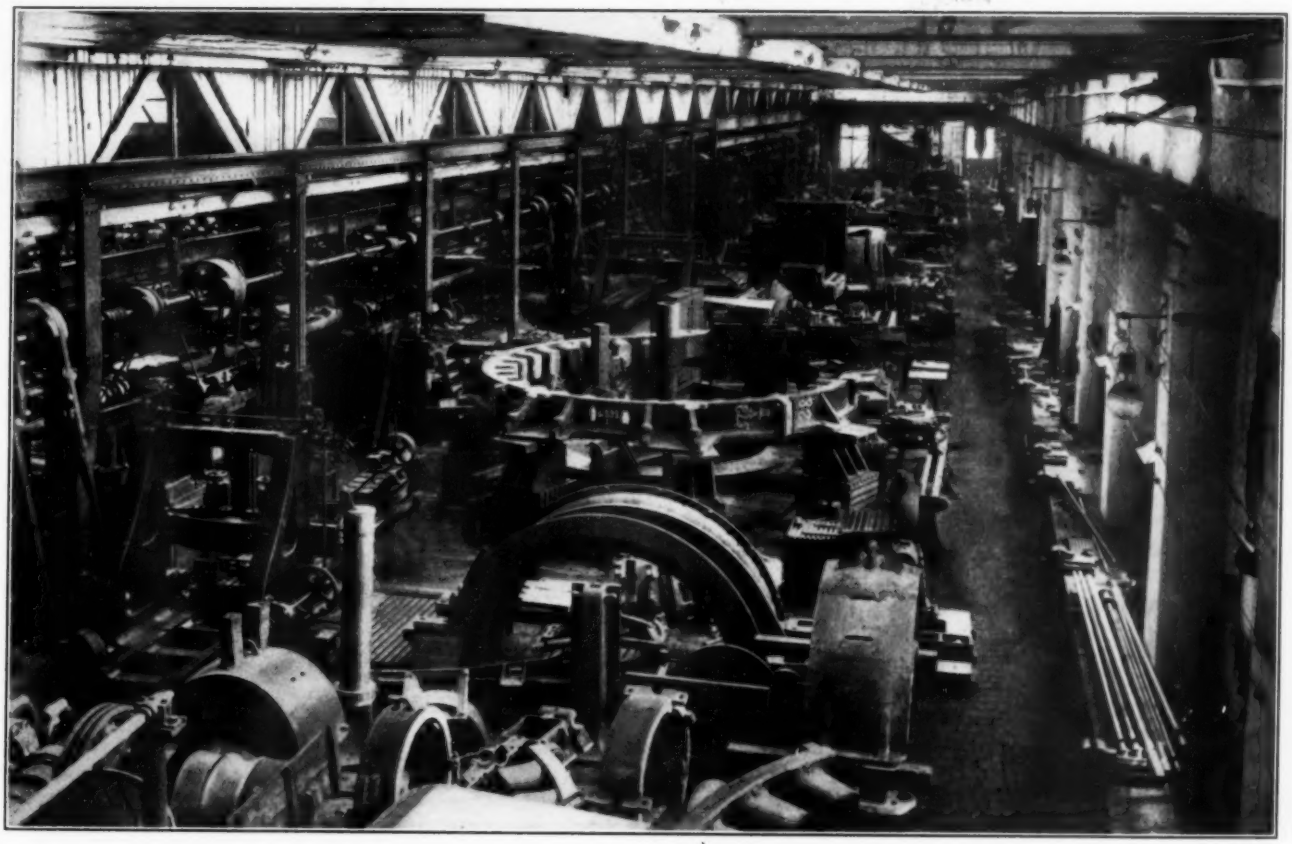


FIG. 3. LARGE DYNAMO ERECTING FLOOR.

the departments where castings are finished and machined. Finally the safety devices applied to the machines exceed all the legal requirements, and it may be asserted that in this respect (as in all others) everything possible has been done for the best, despite the pressure of work which has been a constant feature since the opening of the works.

Reducing Time on Work by Accurate Time Study.

BY ANTHONY STAFFORD.

One of the most productive measures that I have ever adopted for cutting the time on work is the square inch rule for determining the time that a job should take. For instance, if it be found that a cutting rate of sixty square inches per minute for the roughing cut on medium-size gray iron castings can be attained on a 6-foot vertical mill, and I have found this easily possible, adopt this as the standard cutting rate on all analogous work, say cylinder heads of various sizes, packing ring barrels, flywheels and the like, whether machined on mill, engine lathe or turret lathe; in fact, endeavor to make the rule universal, changing the unit, or varying it for different sorts of work as experience may dictate.

In talking of this method to mechanics who are honestly desirous of making good time, I am frequently met with this argument, "I always put on all the cut and feed that the machine and the tools will stand, taking into account the texture of the casting and the amount of stock." This method would be perfect if all the elements mentioned above—the machine, the tools, the casting, etc.—were perfect, but they are not, and right here comes in the advantage of the square-inch rule. I have found that the reasons why the proper time, as indicated by the square-inch method, is not made, are as various as the machines or jobs on which it is tried. In one case the proper speeds and feeds are not available, but can be made so by inexpensive changes in pulleys or by providing variable speed countershafts; in another case a tool is too light, there is too much stock, or an ineffecutal method of holding the work on the machine. All these matters are of as much importance as the one of whether the man is doing his best, and the betterments thus directly suggested by the fact that on a given machine we are not getting the proper results, as judged by the square-inch rule, make the same man's "best" a very much better performance than it was.

Once a standard, such as sixty square inches per minute on gray iron, roughing cut, is adopted, it is an easy and natural step to a square-inch standard for the job. As for instance 13½ square inches per minute for finishing from the rough, gray iron solid pistons of various sizes, 9½ square inches for piston rings, etc.

Up to this point we have considered the method only in relation to gray-iron work; but, of course, it is as applicable to soft steel, wrought iron or any other material worked on in the machine shop. Some other units that I have used to advantage and that are based on what I consider good work, are as follows: Sixty square inches per minute roughing open-hearth shafts; two and a half square inches per minute for piston rods finished from the rough, including centering, roughing, fitting two pistons (these rods are used on a tandem engine), and cutting three threads, one for each piston nut and one which screws into crosshead.

The figures above, while correct, are not offered as standards of comparison for others, but merely to illustrate the method. Anyone interested can establish his own standards by taking one machine in the shop—get everything about it in good shape and observe the results, then compare the figures obtained with the performance on similar work on other machines, advancing the standards as improvements are made.

The question is frequently raised as to why the cubic inches removed should not be considered instead of square inches, and this would be proper if our object were to test out the operator or the machine; but in view of the fact that our object is to reduce the time taken to finish the product, it would not do at all. To illustrate, one of the first jobs in our shop

FIG. 4. STREET CAR MOTOR SHOP.

which we attempted to better by this method was a large cylinder head, approximately 48 inches in diameter, which was taking nine hours. The results obtained in square inches on similar work indicated that this head should be machined in five hours, and one of the principal reasons why it took so much time was an excess of stock. The removal of this from the pattern, a better chuck for holding the work and a twelve-inch larger pulley on the line shaft brought the average time on the heads down to four and one-half hours.

The square-inch method of judging of the value of a performance on machine tools is good, because it indicates possibilities in time reductions far in advance of what is ordinarily done. The belief in the possibility leads to increased speeds, larger feeds, better arrangements for holding the work, better tool steels and better tools; it gives a fixed point to work for, and one which the devotee of the system believes can be reached. It is better than the cubic-inch rule, because it suggests reductions in patterns where stock is excessive, while the latter method would put a premium on "lots of stock," and would not attract attention to the time wasted in its removal.

I have applied this method to the whole range of work, on pieces having sufficient area to make it worth while, in a shop building a large variety of steam engines and pumps, with most gratifying results, having reduced the time on jobs from one-half to two-thirds on a great variety of pieces.

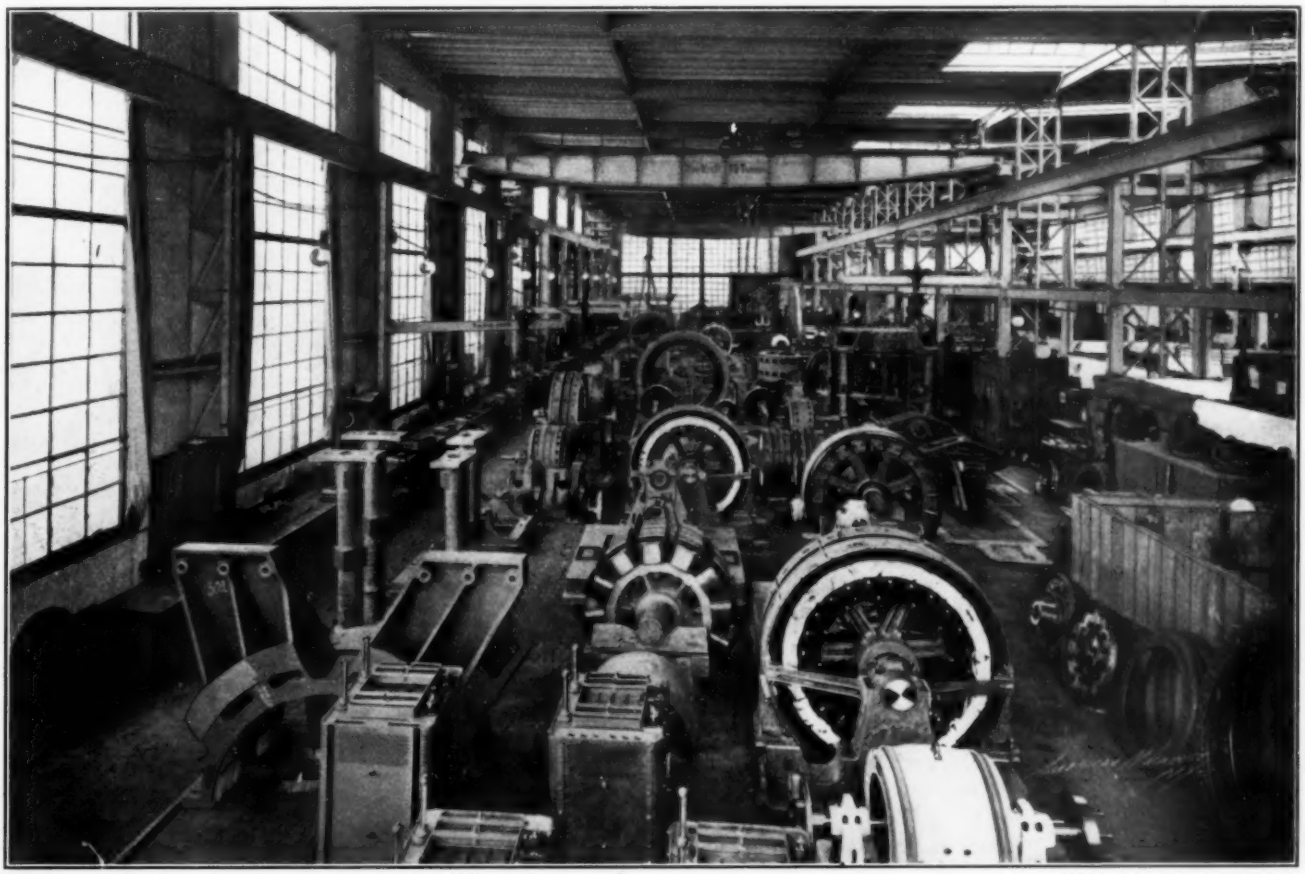


FIG. 5. MEDIUM SIZE DYNAMO ERECTING FLOOR.

Crystallization Experience.

We take the following from a paper by Walter H Finley before the Engineering Association of the South:

While connected with the New Soddy Coal Company, at Soddy, Tenn., I had my attention called to a very practical demonstration of the fatigue of metals by crystallization. The track connecting the mines with the railroad must follow, to some extent, the sinuosities of a restless stream. The result is an incline 7,200 feet long, with 210 degrees of curvature and a difference in elevation of 450 feet; the heaviest grade is all above the center. A "trip" of 36 one-ton mine cars will be on the steepest part of the hill, while the empty "trip" at the other end of the rope is on the flats below, offering very little resistance to assist the brakes in holding the loaded "trip."

It is a thrilling ride, even to one accustomed to it, to make the journey from tipple to mines, seated in one of a string of empty cars 100 yards long, around curves, over bridges, and along the sides of deep ravines much too picturesque and rugged to be associated with a prosaic coal mine.

About a year after this incline was put in, the loaded "trip" parted on the hill, with the result that possibly half of the thirty-six cars could be used again without having to be entirely rebuilt. The coupling that parted was found without a pin, which in mine hitchings is not removable from the clevis without breaking. The wreck, therefore, must have been caused by the breaking of this 1⅛-inch pin, tho it and the balance of the hitching was made by William Harris & Son, of Pittsburg, who use nothing but the highest grade iron.

Not more than two weeks later this accident happened again in identically the same way. I was fortunate enough this time, however, to find a piece of the broken pin, which showed, instead of the dark, velvety appearance one would expect, a bright, crystalline fracture, like burned steel. Following this clew, several hitchings were laid on an anvil and the pin broken by a single blow from a sledge. Pieces of the broken pins were then heated to a bright red, and, after cooling slowly, were again put under the hammer, which failed entirely to break them. After cutting with a cleaver, the pins were broken, and the fracture showed a complete restoration of the fibrous structure. This annealing process was then applied to the whole supply of hitchings. Piles of twenty-five or thirty were covered by a hot wood fire, which was allowed to die down and go out, leaving the hitchings in a bed of ashes to cool off slowly. By repeating this every six months the danger from brittle pins was entirely avoided.

Layout and Construction of Cams—VI.

BY CHARLES F. SMITH.

CAMS FOR PRESCRIBED MOVEMENTS.

The general principles from which cams for prescribed movements are laid out may be gathered from the methods given in Figs. 6, 7, 10 and 11 for cams giving a uniform instead of a crank motion, for the uniform motion is often prescribed and hence those examples fall under this class. The general method is to work backward from the movement required and thus determine the form of the cam groove which will give the movement instead of laying out the groove to give an easy start and stop.

Fig. 36 is another illustration of this method which is given purely as such, and not as an example of the methods followed in steamboat engine work, in which this general form of cam is chiefly used.

The vertical arm is driven by an eccentric which of course revolves uniformly, the angle of swing of the arm being 90 degrees, as shown by the arc of movement. The chord of this arc is made the diameter of the throw circle, which also represents the eccentric movement and which is divided in the manner already repeatedly shown and the division points are projected to the arc of movement and numbered. Radius lines thru these points give the corresponding positions of the vertical arm and these radius lines are carried past the center, as shown.

The toe is supposed to be raised from its seat during half a circle of revolution of the eccentric and to be at rest on its seat during the other half. If the movement of the toe is to be uniform, its throw is divided into equal parts to the same number as the divisions of the throw circle and arcs are struck from the center of the wiper shaft and thru these division points. The radius lines extended to cut these arcs give points from which tangents are to be drawn and a smooth curve tangent to these tangents is the required curve of the wiper. It is obvious that any required movement could be given to the wiper by properly spacing the division points of its left.

A COMBINATION MOVEMENT.

Of all prescribed movements the uniform motion is the most common, and it is frequently used in combination with the crank motion, the latter being used to give an easy start and bring the parts up to the speed of the uniform movement and again to gradually slow down the movement at the end. An example of this is given in Fig. 37, which is from the paper folding machine already referred to.

A is a roll over which the paper is brought to the working parts of the machine. A shield *C* starting from rest at position *D* must at *E*, where it picks up a flap in the end of the paper, reach the speed of the roll and thereafter travel at the same speed as the roll and deliver the end of the paper between the feed rolls *a b*, the end of the movement being on line *F*, when the shield must return to its initial position. The size of drum *A* is such that the shield must make two complete movements for each revolution of the drum.

The angle of the drum movement during which the initial movement of the shield is to be made is 24½ degrees and the angle during which the uniform movement must be made is 38 degrees, both as shown. The drum and cam shafts are connected by gears *A*, *B*, *G* to give two revolutions of the latter to one of the former and angles of 49 and 76 degrees—twice those of the drum shaft—are laid down as shown. Radial lines *c d*, *c e*, *c f* at these angles determine the position of the beginning and ending of the two cam curves. The movements of the sector pinion *H* for the two movements of the shield are determined and laid down on the pitch line of the sector *I*, each side of the center line of the sector's movements, and radius lines to the center of the sector arm determine the two throws of the roller on arc *J*. Dividing the first angle of movement into equal parts, we draw the arcs 1 *a*, 2 *a*, 3 *a*, etc., thru them and then lay down the throw circle *K*, which is here a quadrant only, and from divisions obtained as before draw arcs, of which 0 *a* and 6 *a* only are shown, and thus determine the first portion of the cam curve. The second uniform portion of the movement is laid down in equal divisions at the left of the throw circle and arcs thru these divisions determine the second portion of the movement. The complete return is laid out from another throw circle *L* and the beginning of the first curve and ending of the second are connected by arcs of circles from the center of the cam shaft and represent a dwell in the movement of the shield. The curve as thus determined is, however, slightly modified by easing off the junctions of the uniform and crank motion curves in order to avoid abrupt corners.

The above example will serve also to show the method of dealing with cases in which cams are mounted on shafts that run at different speeds, the angles of the main driver being multiplied or divided, as the case may be, when laying out the various cams. It is often an advantage to speed up certain cam shafts, as thereby the number of degrees during which movements take place being increased the necessary size of the cams is correspondingly reduced. In this way cams which might otherwise be of unwieldly size may often be reduced to acceptable dimensions.

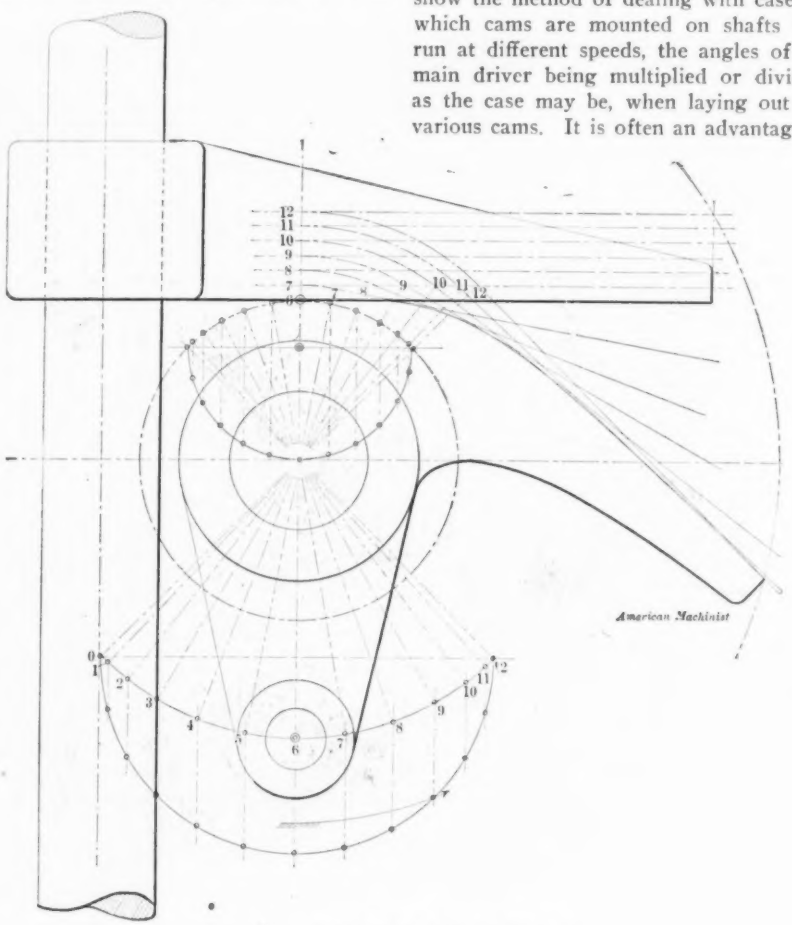


FIG. 36. A PRESCRIBED MOVEMENT CAM.

DETERMINATION OF THE PATH OF MOVEMENT BY CAMS.

In the above cases of prescribed movement the operating points were guided in circles or straight lines by radius arms and slides, the requirement as to the cam relating to the movement only. It frequently happens that not only must the cam determine the speed of the operating

point, but it must also determine the path of the movement, and such cases often develop the fine art of cam design.

Such a case is shown in Figs. 38 and 39, which show a cam movement of which I once made use, and it will serve, without other examples, to show the method of dealing with cases of this kind.

A lever *A* is supported and driven by a radius arm *B* and a slide *C*, which are actuated by cams *D* and *E*, the requirement being that the end *F* of lever *A* shall move in a circle and at uniform speed.

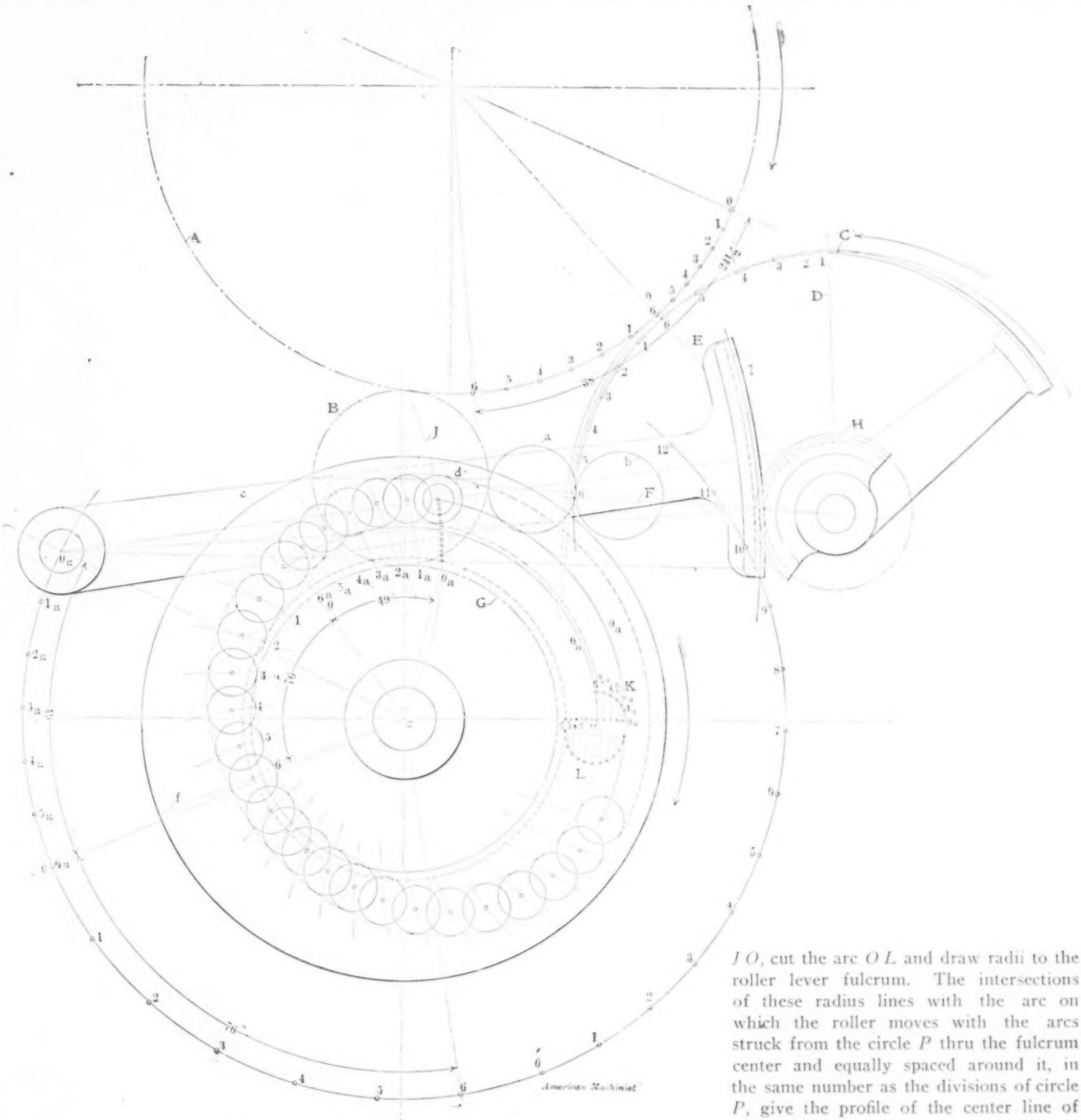


FIG. 37. A COMBINATION CAM.

The method of laying out the cams is shown in Fig. 39. The required circle *P* is drawn and divided into equal parts and trial lengths of the levers and positions of the fulcrums are assumed and laid down. From fulcrum *G* draw the arcs *H* and *I*, the latter being divided equally by the horizontal and vertical center lines. Find the extreme positions of lever *A*, one of which it will be observed is not on the horizontal center line of the circle of movement of *F*. These positions determine the throw of the slide *C* which carries the pivot *J* thru which lever *A* passes. The slide is driven by the lever *K* on which the roller is mounted. From the fulcrum of this lever draw arcs *O L* and *M*, and cut the former from the centers of the extreme throw of slide *C*, and thus determine the extreme positions of the roller. Now take the distance *F N* in the train, and starting at point *F* cut the arc *I* for each division point of circle *P*, marking corresponding points with numbers and letters to avoid future confusion. When all the points have been found on arc *I* draw a line from each division point on circle *P* thru the correspondingly numbered points on arc *I*, cutting the center line of the slide *C*, and number the points to agree with the previous numbers. Set the train to the distance *J O*, cut the arc *O L* and draw radii to the roller lever fulcrum. The intersections of these radius lines with the arc on which the roller moves with the arcs struck from the circle *P* thru the fulcrum center and equally spaced around it, in the same number as the divisions of circle *P*, give the profile of the center line of the disk cam.

To find the roll centers of the perifery cam which drives lever *B*, draw lines from the division points on arc *I* thru the fulcrum *G* cutting arc *H*. When these points have been established and numbered assume the circumference of the cam, divide it into the same number of parts as those of circle *P*. Draw arcs from fulcrum center *G* with a radius equal to that of

the roller arm, and intersections as shown define the cam groove.

The movement shown is continuous, but it might be made intermittent if desired, tho the cams would have to be larger to maintain equally favorable angles, and, obviously, the prescribed movement might be a square or any other figure within reason.

Fig. 40 illustrates a special cam which gives a square movement in a very simple manner, the movement obtained being shown by the square at the left.

To lay out this cam the radius *B* is assumed sufficient for the movement required, and the arc *E* is drawn. From the intersection of this arc with the horizontal center line the length *D* equal to half the required throw is laid down, and the perpendicular *F* is drawn. From the intersections *G G* the arcs *H H* are drawn and from the same centers, with radii *K K*, the arcs *I I* are drawn. Finally from the center of the shaft the arc *J* is drawn, completing the outline.

This cam may be made to operate two surrounding frames placed one above the other, the cam being as thick as both frames combined. If the opening of one of these frames is increased horizontally and the other vertically and the frames are properly guided, a horizontal movement will be given to one and a vertical movement to the other, the movements being alternate. By connecting one of the frames to the operating point by a bell crank two parallel slides may be given alternate movements, and by varying the length of the bell crank arms the movements may be made to differ in length.

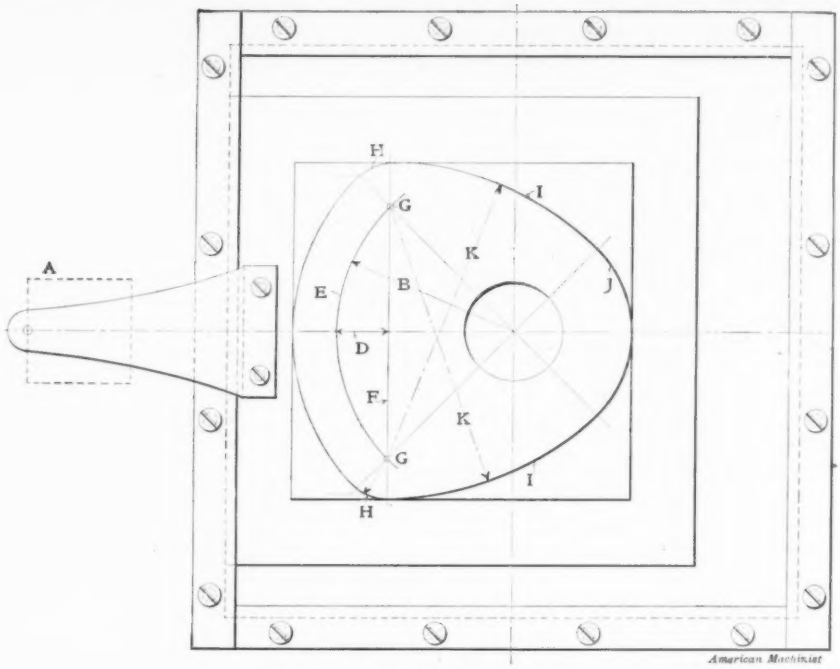


FIG. 40. A SQUARE MOTION CAM.

These articles might be extended indefinitely, but it is believed that enough has been said and shown to indicate the method of attacking and solving cam problems. The subject having been opened up, I hope others may contribute their experience, and thus make available

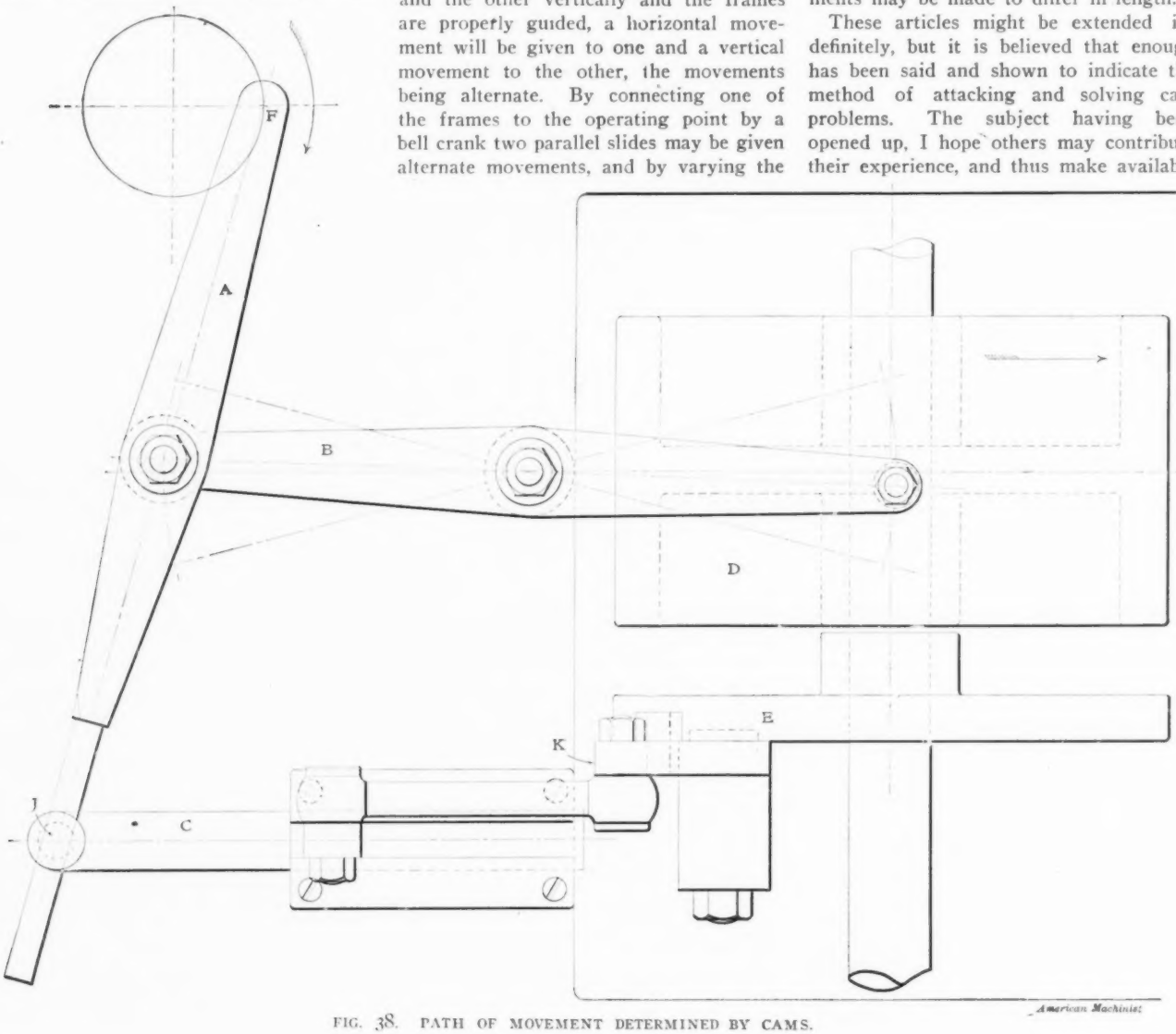


FIG. 38. PATH OF MOVEMENT DETERMINED BY CAMS.

a collection of information that should be useful to all.

The prejudice that exists in many quarters against the employment of cams is unfounded. The movements which they are capable of giving is unlimited, and in cases in which other means will give the movement it is often at the expense of increased complication and trappy construction. Properly designed on the lines laid down, nothing can be more satisfactory than the operation of cams. Their work is smooth, uniform, direct and noiseless, while their design is not a matter of good luck or of expensive experiment, but results directly from the intelligent application of general principles.

The name of Messrs. Graham, Morton & Co., Ltd., engineers and contractors, of Leeds, is too well known to require more than mention to bring to the mind of the reader some of the famous speed records the company have made for the erection of steel structural work. It is not, therefore, surprising to learn that a contract has just been placed with them for the construction and erection of a large warehouse at East Quay, South Dock, for the Alexandra (Newport and South Wales) Docks and Railway Company. The build- is to be 200 feet long and of 70 feet span, and the whole of the iron work will be in position eight weeks from the date of the order.—*Engineering Times*, London.

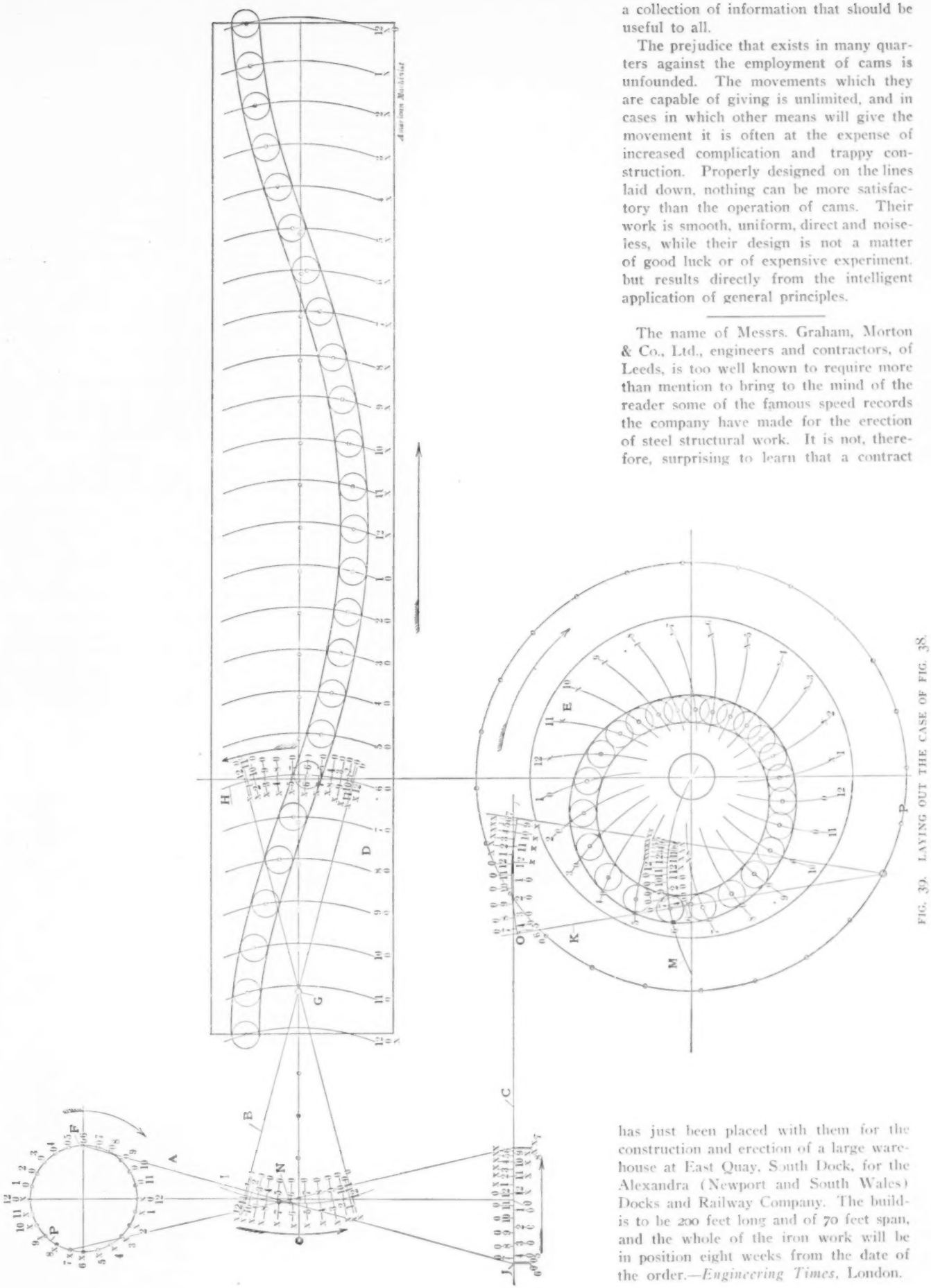
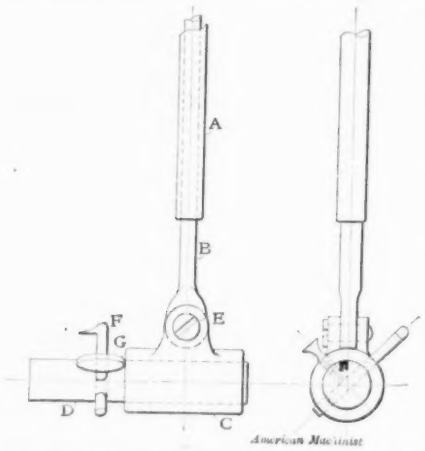


FIG. 39. LAYING OUT THE CASE OF FIG. 38.

Letters to the Editor.

Cutter Grinding in Small-Arms Plant.

I have read with interest the description of the Rock Island Arsenal, and as I have quite recently had an opportunity to go thru this plant, I would like to call attention to a point in shop practise followed there which is not mentioned in the description referred to. This point is the



RIG FOR HOLDING CUTTERS WHILE GRINDING.

method of grinding cutters in the small arms department.

From what I saw during my visit, I conclude that no formed cutters are used in milling the various parts of the rifle, such cutters as I noticed being of the regular milling cutter type and ground along the top of the teeth instead of radially, as would be the case with formed cutters. I noticed a man grinding some of these cutters and think it one of the most interesting and skillful performances I have ever witnessed; for many of the rifle parts milled are of quite irregular outline and to grind cutter teeth freehand so that they shall produce the work to the narrow limit allowed must be a very difficult undertaking. Yet it did not seem to worry the man who was doing the work, and he seemed to be making pretty good time on the job.

The rough sketch herewith, from memory, shows roughly the appliance used for carrying the cutter in front of the wheel, which is mounted upon a plain emery-wheel stand upon the bench. *A* is a long, hollow rod suspended from a universal joint attached to the ceiling, and in this sleeve is an adjustable rod *B* carrying at its lower end a socket *C*, which supports cutter arbor *D*; sufficient friction being provided by joint *E* to hold the cutter arbor in the proper position. *F* is a tooth rest for the cutter and *G* a thumb-screw for clamping the tooth rest after adjusting. The operator simply slides the cutter on the arbor with a tooth against the rest and then swings the cutter past the wheel and by his eye and the sense of touch follows the contour.

The cutter blank is formed in the usual way, I believe, and after the teeth are milled and the cutter is hardened, it goes to the grinder, who grinds off the top of each tooth before the cutter is placed in the milling machine. In subsequent grindings, all he has to guide him is the previous outline of the tooth. After a piece has been milled, if it is not accurate to gage, the cutter is again taken to the grinder.

I know that these cutters and this method of grinding are used in the Springfield Armory, and I think also in some other small-arms plant in the East; for some years ago, while working in the East, I spent some time in the tool shops of New England, where various men from Springfield, from Colt's Armory and similar establishments were employed, and I recall that one man from Springfield told me it was customary at the armory to break in some skillful young man to this work, and that after a time he became so proficient at it that the results obtained with the cutters ground after this fashion were superior to those obtainable with formed cutters; and for this reason, while formed cutters were tried for a time in Springfield, they were afterward abandoned altogether.

It is possible that there are shops other than those engaged in making rifles which use these freehand-ground cutters. Here in the West, however, the only plant I have run across which does this is the Rock Island Arsenal. It would be of interest to hear from some of the men actively engaged in using such cutters as to their advantages over the formed type, so nearly universally employed.

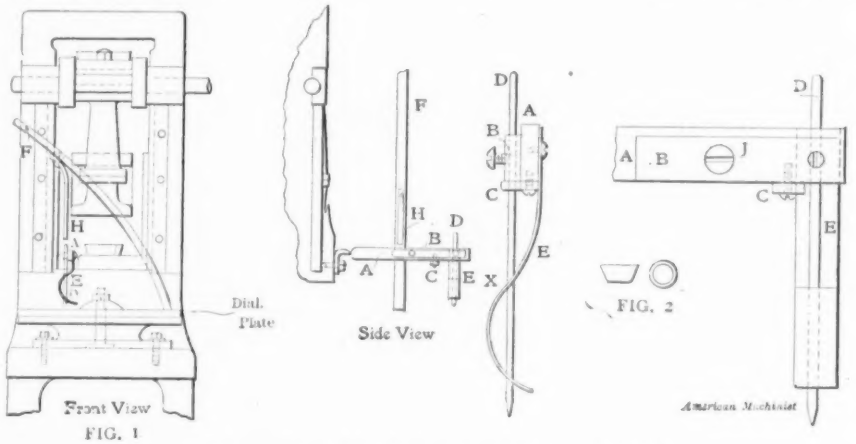
The cutters at Rock Island were certainly doing rapid work and good work; but why should not formed and radially ground teeth be as satisfactory (certainly much easier to look after) as they are commonly used for other work of a very similar nature.

The average toolmaker would, I think be frightened if he were given a gang of irregular mills to grind by the method followed at the arsenal shops; and it must be an operation that only a peculiar adaptation and long experience will enable a man to accomplish satisfactorily. As many as six or eight mills are sometimes used in one gang on this class of work, and that they can be ground—and quickly, too—to mill the parts as accurately as they have to be milled, shows what a high degree of skill a specialist can attain if he has the patience to stick to one line of work.

W. E. STERN.

Automatic Throw-out for Misplaced Shells.

The cuts show a very neat kink that is doing good service in our shop. The drawing, tho not perfect in detail, shows enough, I think, to make plain the main point of which I am writing. The presses are worked with dial plates. The shells, a sample of which is shown at Fig. 2, are of tin, and are fed into the plate by means of a hopper, which is supported by an arm extending from the top of the press. The theory of having the presses working on the self-feeding plan sounded all right, but in operation it was found that some of the shells worked into the plate upside down, or occasionally two at once. When they came down in this manner, and the plate moved around to the punches, instead of performing the operation, it either ruined the punches or stopped the press. As no positive escapement could be devised, this little kink was made, which would remove all shells not in the right position. *A* is a piece of soft stock, twisted at right angles, and is bolted to the gate of the press. *B* is a piece which swings on *A*, and is prevented from dropping by the stop *C*. *D* is a magnetized pin, and can be adjusted. *E* is a strip of tin, which fits over the pin *D*. On shute *F*



AUTOMATIC THROW-OUT FOR MISPLACED SHELLS.

is a strip of steel, which comes directly over *B*. As the chute F is always stationary, and *A* being bolted to the gate of the press, when *A* comes up a certain distance *B* comes in contact with *H*, and as *B* is movable on the screw *J*, it moves upward. As the strip *E* also moves on a screw, it moves upward on the pin *D*, gradually nearing the point. The pin *D* is set so that it comes directly over the holes in the dial plate, and is also adjusted so that when the press comes to the full drop the magnetized pin *D* will attract any shell wrong side up, but not interfere

with the one in the right position. It can be seen if any shells drop in the plate wrong they stick to the pin *D*, and when the gate ascends *B* strikes *H*, causing *B* to go upward, drawing *D* with it, which slides thru the tin strip *E*, and when it gets out to the position marked *X* it knocks the shell off, which drops in a box ready to receive it. Its simplicity and surety should recommend for similar classes of work. PEDRO RE.

A Cylinder Boring and Facing Rig.

The shop was badly pushed for cylinder boring machines to keep up with the increase of orders, and to help out we made a boring bar and fixture as per sketch to suit an old, altho powerful, lathe. The results proved that we had made no mistake.

The first thing to do was to get the old lathe into as good condition as possible by making new spindle boxes, alining and surfacing the carriage so that the work table would have good bearings, etc.

C is the work table, made large enough to nearly cover the entire carriage and suitably T-slotted to suit the feet of columns *A*, there being four such columns, all tongued to the table slots, four bolts being used to hold each column to the table. The columns are moved to or from the center to suit the work diameter, and for long or short cylinders the columns are lifted from one table slot to another.

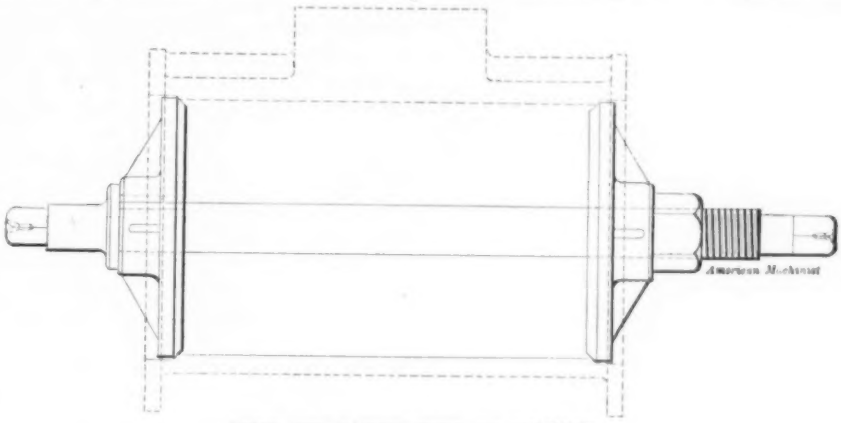
The sketch shows a 16-inch steam cylinder resting upon parallels *B B* and held down to the work table by jack-screws engaging cored pockets in column *A* and the feet of the cylinder (see Fig. 2). Each column has a long opening cored thru from the face to the back and from near the top to within 6 inches of the base or foot, to allow a sleeve nut *H* to be moved up or down. This sleeve nut was flatted on opposite sides near the face of the column, so that it would not turn when the nut was being tightened. *D D* are square-thread screws passing thru the sleeve nuts, and coming in contact with the cylinder at four points, effectually taking care of any side vibration.

Dotted line *F* indicates a pump cylinder valve chamber, and when such a cylinder was to be bored the sleeve nuts with screws *D* were moved near the top. Screws *D* were used to locate the cylinder when setting, and after it was in the exact spot desired the opposite columns were fastened together at the top by the extension tie rods and threaded hand-wheel nut, as shown in Fig. 2. The mild steel lugs at the tops of the columns are milled out "U" shape and upon releasing the hand-wheel the rod can be readily removed. The end thrust of the cut on the cylinders is taken care of by bolting a knee to the table and against the inner face of the flange (see Fig. 2).

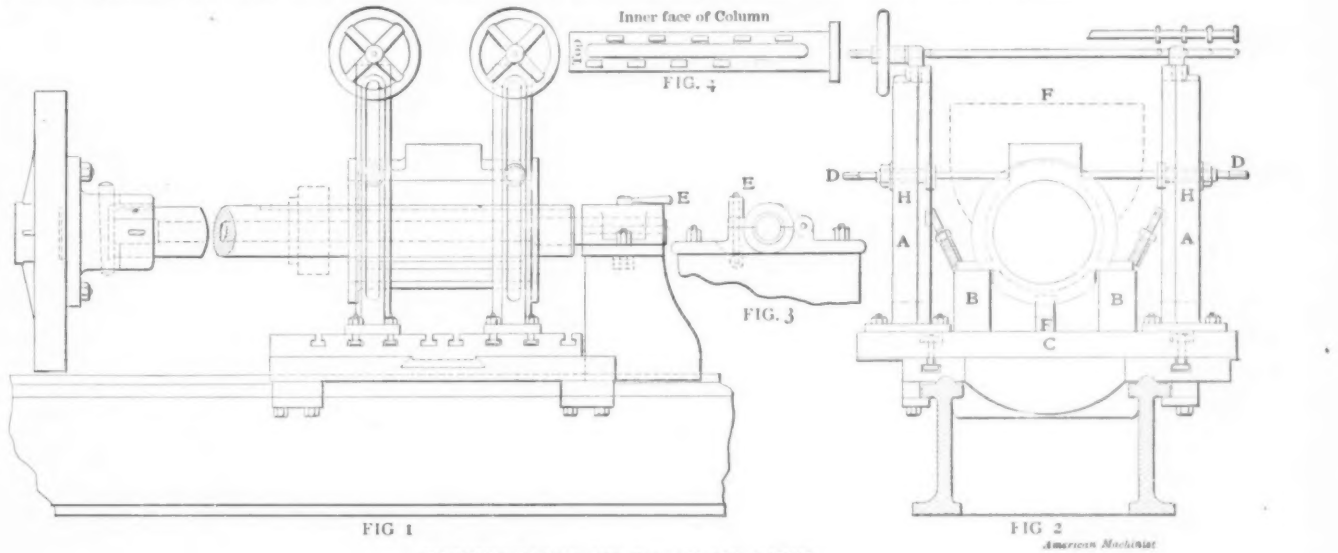
The 8-inch boring bar is a hollow gray-iron casting, the end being bored to receive a steel plug with projecting journal, as shown in Fig. 1. We do not use the lathe centers, but prefer the bar holder and drive shown. The bar is fitted to a taper hole (1-16 inch taper per inch), is held back by a taper draw key, and is also keyed to the bar holder. The draw key is used also to force out the bar when necessary to remove it.

The other end of the boring bar has a 4x14-inch journal running in a bronze bushed bearing, as shown in Fig. 3. Of course it was necessary to remodel the upper part of the footstock, so we replaced the discarded part as per Fig. 3. The cap of this bearing is hinged, and can be thrown up so as to remove the bar when desired. The hinged cover is held down by tightener *E* and swing bolt. In removing the bar and cylinder from the lathe, the footstock is run back six inches or more. On starting to bore a cylinder the proper sized head is placed upon the boring bar, the bar is covered with canvas or something similiar for protection and put thru the cylinder, when all is lifted together by the crane.

"Jerry" with this rig set the cylinder and got a cut started in twenty minutes. We make no attempt to face the ends of the cylinder in this, as we consider it unprofitable to put on and take off the facing heads for each cylinder bored.



ARBOR FOR FACING ENDS OF CYLINDER.



CYLINDER BORING RIG FOR AN OLD LATHE.

Fig. 5 shows the facing arbor as used. The cylinder is indicated by dotted lines. The arbor is 3 inches diameter, and is squared at each end to receive a wrought-iron carrier, a collar being forged and finished upon the arbor 8 inches from one end, and against this one of the cylinder centering heads was forced, a key also being placed in the centering head and arbor to make the drive positive. The

other centering head is a sliding fit, and it is forced against the cylinder counterbore shoulder by the nut. The cylinders to be faced can often be done at both ends without reversing the arbor. For the facing of all cylinders, say, up to and including 14 inches bore, a two-carriage lathe and special arbor is used. Altho boring cylinders in a lathe is far from being up to the minute, the quality and quantity of work produced was very satisfactory.

BECK.

Piston Plugs and Pistons.

Many valuable lessons can be learned from the articles, "Things That Are Usually Wrong," and No. VII at page 93 set me thinking.

Fig. 1 shows a simple way of avoiding

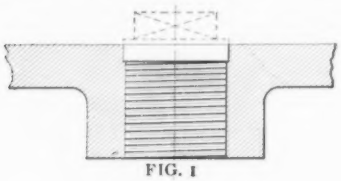


FIG. 1

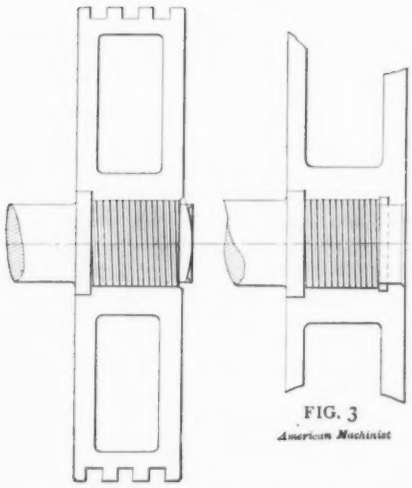


FIG. 3

FIG. 2

PISTONS AND PISTON PLUGS.

the streak left by the broken thread when plugging holes. After the hole has been tapped, or before if preferred, drill it out to the diameter of the bottom of the thread a short distance down, and turn the plug to fit it. It is then screwed in and machined flush.

Another case of the same kind came under my notice recently. It was a 3-inch piston rod which was screwed into the piston block and riveted over. While being faced up in the lathe a part of the screw dropped out, leaving a hole. Sometimes such a piece drops out in the cylinder instead. The remedy is shown in Fig. 2, which is very simple. The thread is taken off the rod after it leaves the countersunk and then riveted over. There is perhaps a little more riveting to be done, but there are no loose pieces to drop out afterward.

Fig. 3 shows a still better way, which is not to screw the block all the way, but leave it as shown. This makes the best job and takes very little riveting over.

D. L.

A Typewriter for Lettering Drawings—Fountain Ruling Pen.

I have read with interest the "Shop and Drawing Room Suggestions" of Mr. Ingham at page 362, and I will say that the very minute I saw the first book typewriter I was struck by the same idea: why not apply something of this style to the drawing board? I would suggest that it could be attached to the universal drafting machine, insuring alinement, ease of movement, etc.

Apropos of fountain pens for lettering, and a fountain ruling pen, I enclose a circular from a party who claims he "got it" as to both. I have made a brief trial of the fountain ruling pen and found it satisfactory.

E. KWARTZ.

[The pens mentioned by our correspondent are named "Klio," sold by Louis Winter, Reading, Pa.—Ed.]

Arrangement of T-Square for Long Drawings.

During my long experience as draftsman and designer, while working on long drawings, such as large arrangement plans and assembly work, I have always found it quite a proposition to find a long T-square sufficiently reliable for accurate and delicate work. On the other hand, the two triangle system cannot be thoroughly depended upon, from the fact that it is somewhat treacherous, due to the slip of the triangles, to say nothing of the time consumed in lining up the triangles for every few lines drawn. Again, to use an ordinary short T-square on the board across the narrow way, is to be constantly annoyed by the head of the square coming in contact with the body while sliding along the front edge of the board or table.

I at last devised a scheme which is clearly shown in the illustrations of which Fig. 1 is a plan and Fig. 2 is an elevation. The runner *A* in Fig. 1 is a plain piece of hardwood, such as cherry, of a length to suit the board or table having straight edges on either side, and having secured to the under side of one end a block *B*, which is made slightly convex on the inside next the table edge, so as to allow the runner *A* to be slightly swung to either side in order to line up the T-square. Thru the block *B* is driven a small piece of pointed steel *C*, such as a little wire nail, of length just sufficient to allow the mere point to protrude on the inside enough to engage the edge of the table or drawing board and prevent slipping. On the other end is a small knee or clip *D* made of a strip of about No. 14 brass ¾ inch wide, notched in flush with the under side of *A* and secured to same by means of small countersunk wood screws.

Thru the vertical arm of *D* a hole is tapped for about an 8-32 thumb-screw *E*, the point of which clamps to the front edge of the table or drawing board. This permits the runner *A* to be quickly and conveniently shifted to any desired position on the table or drawing board. The inner edge *G H* on the head of the T-square slides along the straight edge of the runner *A*. The head of the T-square is connected to the blade by the block *F* which is cut out to pass over and clear of the runner *A*, as shown in Fig. 2.

The advantages of this square over the ordinary T-square will be seen to be as follows:

1. It is light and handy, and can be placed on a table or board of any length at any desired point, and accurately lined up with the work.

2. The working edge of the runner *A*

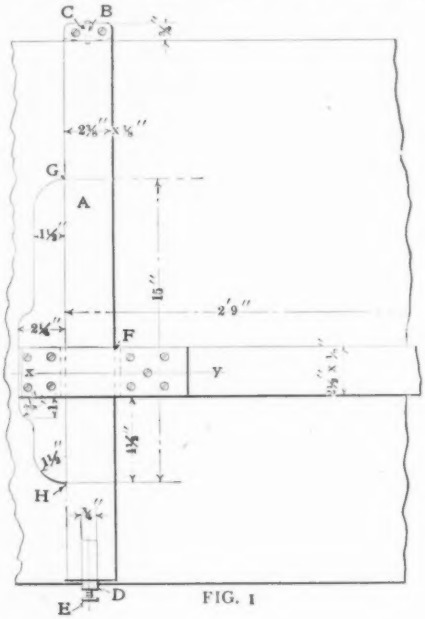


FIG. 1

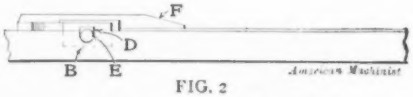


FIG. 2

T-SQUARE FOR LONG WORK.

is always protected and does not easily become battered and scored up like the working edge of a drawing board or table.

3. And most important is its extreme accuracy. Those who are familiar with the working of an ordinary T-square the head of which overhangs the board are conversant with the fact that it takes but a slight depression or elevation of the points corresponding to *G* and *H* in Fig. 1 to throw the end of the T-square at *J* out a sixteenth of an inch or more, depending on the length of the blade.

It will be readily seen that this error is entirely eliminated in the arrangement shown, inasmuch as the entire bottom surface of the head is in the same plane, and slides on the flat surface of the table or drawing board.

4. To say nothing of the weight, the clumsiness and the unhandiness of a long T-square, the entire weight of the head

is supported by and drags along roughly over the edge of the drawing board, while the head *G H* in Fig. 1 slides smoothly along the flat surface, and it is surprising to see how easily the whole square is shifted. J. W. H.

Indicating Machinist's Dimensions on Drawings.

The question that often arises in the drafting room is, by what means can the machinist distinguish his figures from those of the patternmaker on a fully dimensioned drawing or print? I find on investigation that different manufacturing establishments employ various methods of making this distinction, some making two tracings from the same drawing, one having the dimensions for the patternmaker and the other those for the machinist.

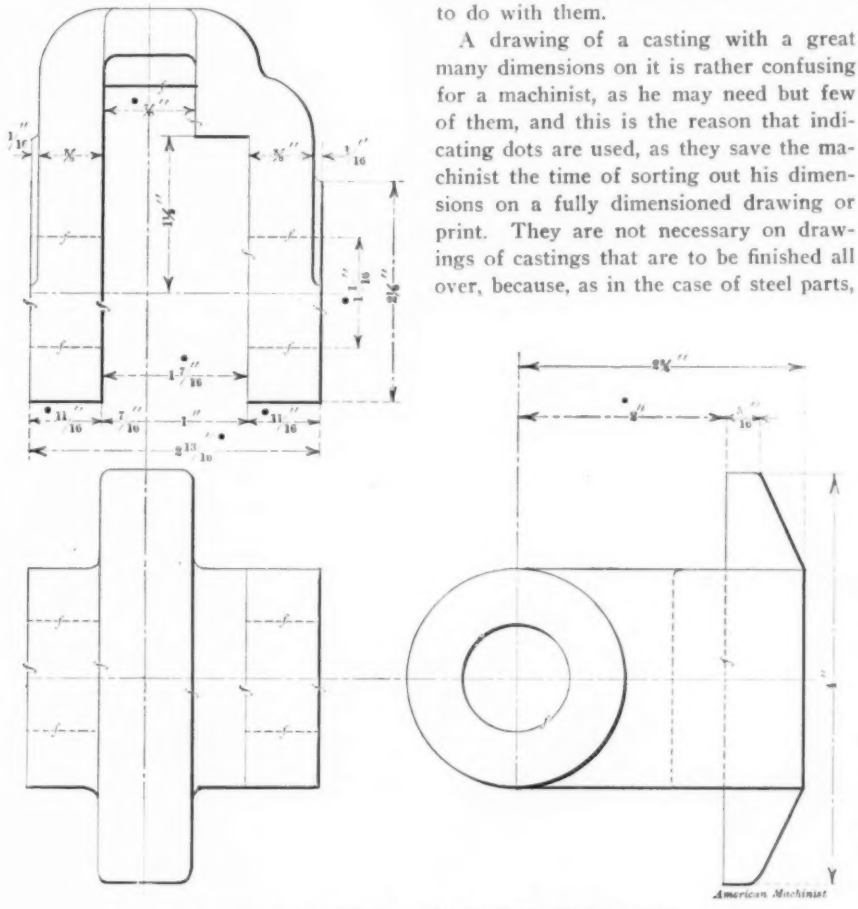
We found on trying this method that there was a great deal of extra work in making the extra tracing in addition to a still greater chance of making errors, because when a change had to be made on the tracing, seven times out of ten it would be made on one tracing and neglected on the other. A great many will ask the question why two tracings should be made from one drawing. The object is to have one print for the machinist with dimensions that concern him only and, similarly, for the patternmaker.

We tried two or three other methods, but they did not prove successful. After many experiments I discovered a system that works very well and which we are now using with success.

After a tracing has been inked in, a round dot 1-16 inch in diameter is made with the bow pen over and a little ahead of the figures that concern the machinist, as shown in the illustration. These indicating dots are used with dimensions on drawings of castings that are to be machined. They are not needed with dimensions of steel parts, as all the dimensions of steel parts are of concern to the machinist and the patternmaker has nothing to do with them.

A drawing of a casting with a great many dimensions on it is rather confusing for a machinist, as he may need but few of them, and this is the reason that indicating dots are used, as they save the machinist the time of sorting out his dimensions on a fully dimensioned drawing or print. They are not necessary on drawings of castings that are to be finished all over, because, as in the case of steel parts, all the dimensions of such things are of concern to the machinist.

A great many will ask, why we do not use finish marks on the pieces that are to be machined. This we do, but a finish mark does not tell the machinist that such and such a dimension is a center for a drilled or tapped hole, while these indicating dots do tell this, in addition to calling the machinist's attention to the fact that this part or that part has to be finished. H. A. FALARDEAN.

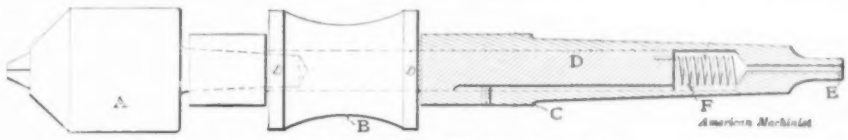


INDICATING MACHINIST'S DIMENSIONS ON DRAWINGS.

Sensitive Hand Feed for Small Drills.

For very small drilling, such as No. 50 drills and smaller, the chuck *A* is an ordinary ⅛-inch Beach chuck adapted to large drill presses or lathes; the object being to get a light finger pressure on the drill like on a watchmaker's lathe, making it a useful tool on die work, etc., where a broken drill will cause trouble.

The adapter *C*—of suitable taper to fit the spindle—must be bored and reamed true in the lathe. The spindle *D* can be made of ⅝-inch crucible steel, turned down on one end to fit the hole in *C* and splined. It is kept in the upper position by the spring *F*, which is first fixed to the spindle end. Part of the spring wire is left straight to lead out at the hole *E* and is then fastened. In action you push down on *B*, which is a fiber spool running between two collars. The spring *F* is just strong enough to lift it. Thus, in small holes, you can work the drill up and down rapidly to keep it clear of chips and not have to move the lever at all.



SENSITIVE HAND FEED FOR SMALL DRILLS.

On the lathe, for laying out small holes in dies on the face-plate, this is the ideal tool. This fixture should be made to fit both the drill press and the lathe. It also could be used to advantage on the screw machine. J. A. PETERSON.

A Little Primitive Sawmill Experience.

My first experience with steam machinery was brought about by a violent wind storm which came along one night in November and blew down thousands of feet of timber in the town in which I lived. The local mills would not offer a decent price for it, as they felt certain of getting it at their own price if they waited. Finally, two of the men who had the most timber to dispose of got some outside parties to bring a mill there to saw it up.

It was a portable locomotive boiler with the engine mounted on its back. It was delivered about the middle of January when the thermometer stood at from 12 to 20 degrees below zero nearly every morning, and in three days' time it was set up out of doors and a well had been driven to supply water. The hands worked entirely unprotected from the weather until they had sawed boards enough to build a shanty over it.

It was at this time that I had my first glimpse of sawmill practise as to safety valves. With the weight furnished the steam would blow off at about 80 pounds, and as that was not enough to run the mill when sawing large logs, a two-foot monkey-wrench was clamped on the lever and several spare ells were strung on a

piece of rope and added to the weight. This was effectual in keeping the valve down, as I never saw the steam pressure open it, altho it sometimes rose to 160 pounds.

When the snow melted in the spring and the ground began to get dry there were many small fires started by the sparks from the stack. One windy day a spark caught in a fence within a few feet of a neighboring barn, and it was blazing up about 10 feet high before it was discovered. All hands left the mill and succeeded in putting out the fire before any serious damage was done.

While the fire was at its worst the owner of the barn was seen with a bucket filled with potatoes looking for something to empty them into so that he could use the bucket to fight the fire, thus affording another illustration of the absurd things that one will do when excited. Within a few days the work was finished and the mill moved elsewhere. W. ALTON.

Adjustable Drilling and Milling Fixture for the Drill Press.

The illustrations show a very useful fixture for the drill press that can be used to advantage on the miller, but it is designed more for use in shops that have no miller. It is a great time saver for slotting boring bars, milling keyways in round stock, and various other operations. After the fixture has been attached to the drill-press table in correct relation to the spindle, it will readily be seen that when the work has been placed in the "V" and strapped down, it will be located centrally with the bushing in the slide block.

Fig. 1 shows the end view of the fixture. The body *B* is of gray iron and also the slide *A*. The upright bar *F* is of crucible steel and is fastened to the body *B* by the nut on the lower side and also by the key *X*. This bar is also provided with two keyways—as shown in Fig. 3—to keep the arm *C* from turning. The arm *C* is of tool steel, bored to a nice sliding fit on the bar *F*. It is provided with two keys, as shown. They are driven very tight and are held by two headless set-screws to make sure they will not shake loose. The keys should be a nice sliding fit in the keyways on bar *F*. They can be of any convenient length according to the desired range. The arm has a T-slot in it for the sliding block *D;* it is also split at *K* and is provided with a binding screw to lock the arm any distance above the V-slide *A*. There is also a center line on it to line with the center of the "V." This center line is used when milling keyways, making it unnecessary to lay the keyway out. The sliding block *D*, Fig. 4, is of tool steel hardened and ground; the hole is a nice fit for the bushing *E*, which is held in place by the screw *H*—the side of the bushing being slabbed off for the shoulder on the screw. The screw *G* is to lock the sliding block at any point on the arm *C*. The "V" on the slide is made for large work, but is provided with a

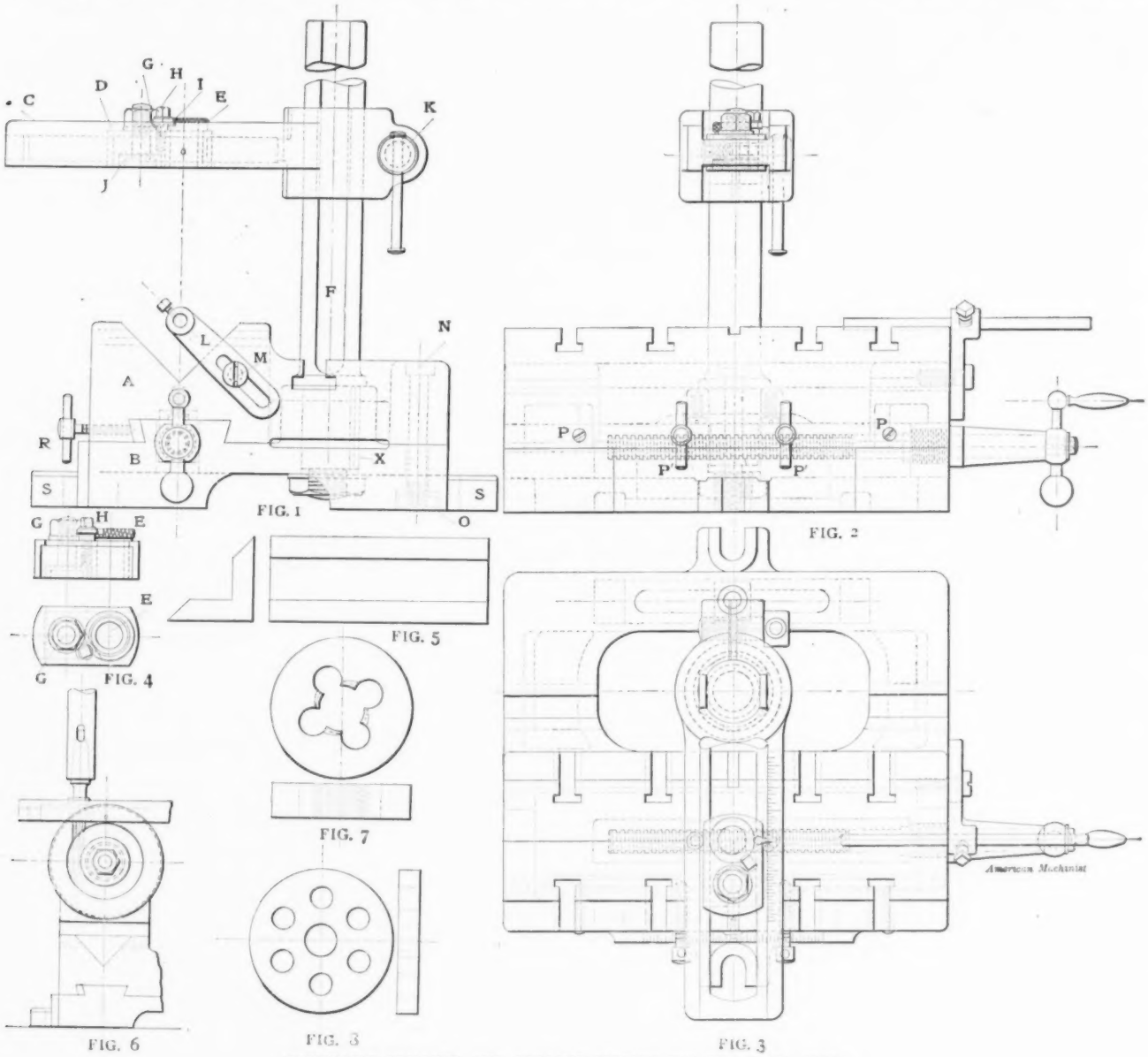


FIG. 1 FIG. 2 FIG. 3

FIG. 4 FIG. 5 FIG. 6 FIG. 7 FIG. 8

ADJUSTABLE DRILLING AND MILLING FIXTURE FOR THE DRILL PRESS.

small V-block, as shown in Fig. 5. Part *L* is attached to the end of the slide *A* and is bored at the end to receive a stop for gaging duplicate work. It also has an elongated slot to adjust it, and is locked by the screw *M*. The body B has two lugs *S* on either side to fasten it to the drill table.

Fig. 2 shows the feed screw for the slide, the gib screws *P P*, the binding screws *P' P'* and the stop. Fig. 3 is a top view of the fixture, the arm is graduated to spacing holes in flat work; it is attached to the drilling fixture on top of the slide, and is fastened with bolts shown in Fig. 11, with a square nut to go in the T-slots. This head is made much the same as any other head, with a worm and gear to revolve the table. The table is screwed to the stub that the worm gear is attached to and is checked by the two small screws *I I*. To lock the table the hand screw *D* is used; this screw is provided with a brass or copper gib. Part *J* is attached ing die is strapped to the table to cut the clearance in it. The sliding block in the arm *E*, Fig. 3, will have to be moved from the center according to the sized die to be machined; as the arm is graduated the sliding block can be easily set the required distance from the center.

Fig. 8 shows the way holes can be spaced on flat work with these two attachments combined. It will readily be seen that they will take the place of a miller for certain work.

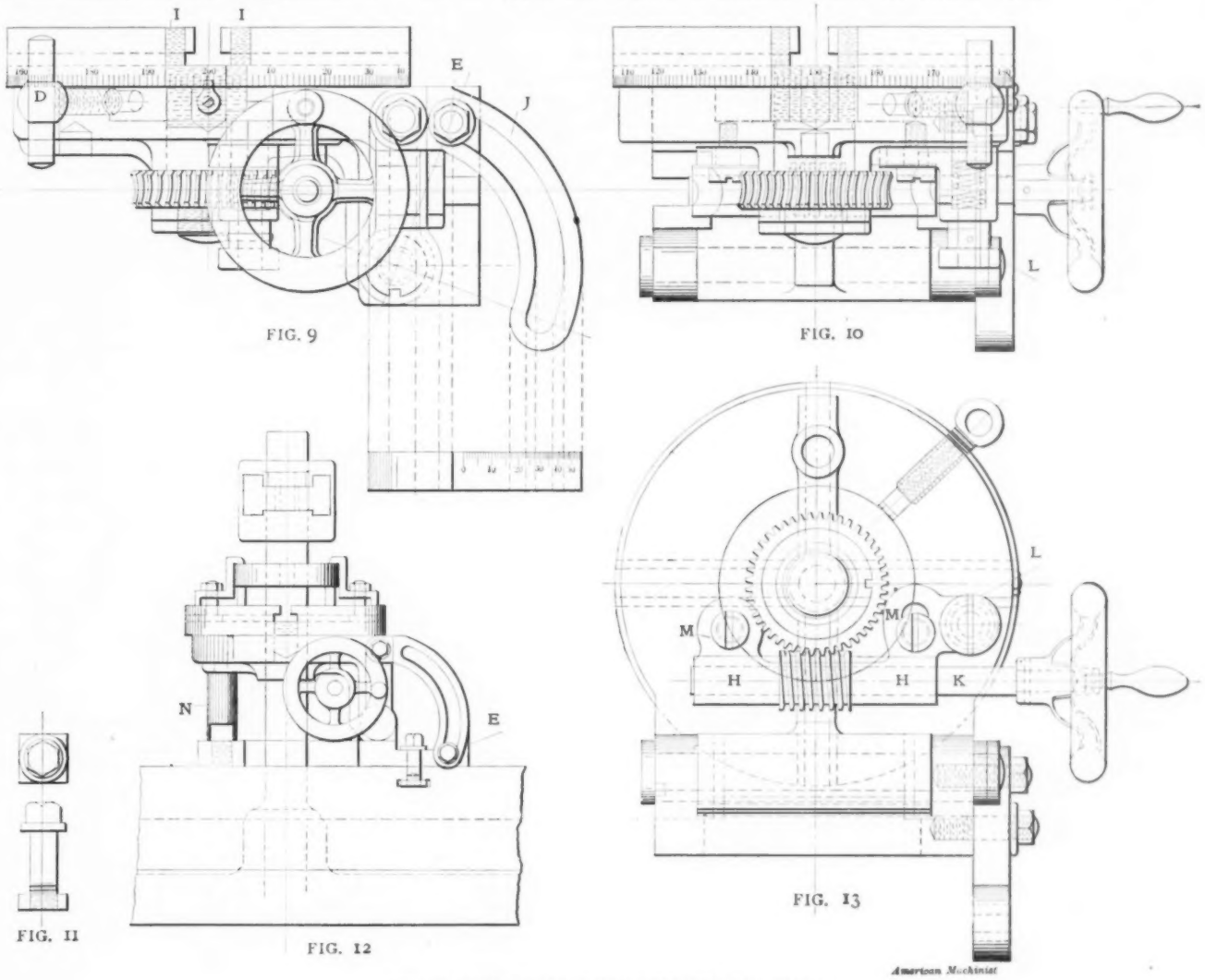


FIG. 9 FIG. 10

FIG. 11 FIG. 12 FIG. 13

ATTACHMENT FOR SPACING HOLES ON FLAT WORK.

read in sixteenths and the sliding block is provided with a small pointer so as to locate it. The arm and the body are also graduated. For slotting boring bars and all similar work the part to be machined is placed in the "V" and securely strapped. A bushing the size of the drill is put into the sliding block and locked by the screw *H*—there can be a set of bushings made from 1 inch down as small as desired. The bar can be drilled and spaced any distance by releasing the screws *P' P'* and moving the slide by means of the screw. After the drilling operation by putting an end mill in the spindle the slot can be finished.

Fig. 9 is an attachment that is made for cutting the clearance in thread dies and to the body and has a slot, as shown, and is graduated on the outside. This is used to lock the head at any angle by the screw *E*, as shown at Fig. 12. The table can be tilted from a horizontal to a vertical position, and can be used at any angle desired.

Fig. 13 shows the way the worm is attached to the body part. *H* is bored and reamed to the size of shaft *K*. The worm is keyed to the shaft. Part *H* is fastened by the two screws *M M;* the right-hand lug has an elongated slot, so by loosening the screws *M M* and releasing the latch-pin *L* the table can be revolved by hand.

Fig. 12 shows the screw *N* that is used when the table is used horizontally. It serves as a jack to hold it steady.

Fig. 12 also shows the manner a thread-

Fig. 7 is a die. Fig. 6 shows a piece being end milled at one side.

AXEL R. NORDSTROM.

Cleaning Tracings.

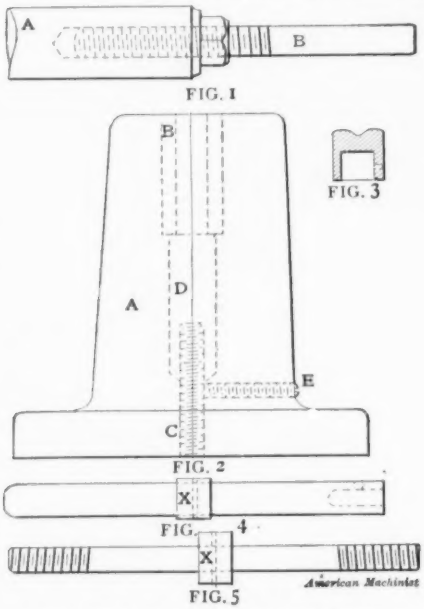
When tracings must go into the shop for lack of time to make prints or other reasons, they generally come back pretty well spotted up with grease marks, so much so that sometimes it is necessary to make new ones or else get bad prints. A good way to clean such a tracing is to first tack it down to a board, and then go over the whole surface gently and liberally with kerosene, letting it soak for a while, then drying off with a clean rag and repeating the process on the other side. If this is carefully and neatly done

the tracings will be clean as new, and can be safely dried on a radiator. The kerosene will not remove the polish from either the glazed or the dull side.

A good way to tell when a blueprint is nearly "done," is to touch it with the thumb *slightly* moistened, and when the mark left by the finger is nearly purple then you can wash the print. J. S. C.

A Stop for the Lathe and a Jig.

Fig. 1 represents a stop for the lathe that will prove handy on many jobs that have to be the same length over all. Skip



THE STOP, THE JIG AND THE WORK.

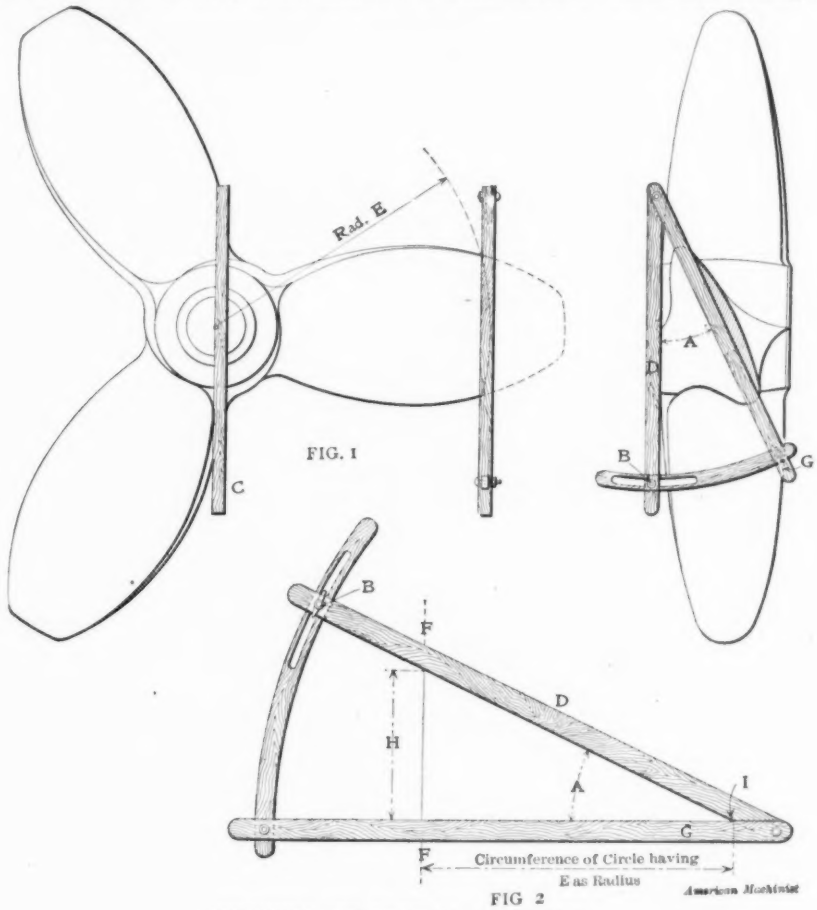
had a number of dies that had to be the same length from the bottom of the hole to the face. He had a universal chuck, and could set his forming tool to a stop. But what puzzled him was how to set the dies in the chuck the same distance each time. He tried a few kinks, but without success. Finally, he worked out one that proved not only successful for that job but on many others since. *A* is an old center trimmed off on the face and tapped out for adjusting plug *B*. The center is put in place thru the chuck. Then *B* is extended out the required distance according to sample, and is locked in place by the nut. The dies, Fig. 3, are larger than *B*, therefore it is not in the way of the jaws. The dies are placed against the stop, then the forming tool is brought up and trims the face until it comes to the stop set on the ways of the lathe.

Fig. 2 is a jig used for holding plungers like Figs. 4 and 5 while driving on the collar *X*. At first these plungers were turned up from the solid. As we used quite a number of these plungers, the foreman decided to use the standard stock and drive on collars the required size. As the plungers are used in connection with Henry's job, the foreman told him how he was to make them in future. So Henry had the stock all cut and formed on the screw machine. Now, he knew if he turned the plungers over to Reddy (the boy working for him) that the collars would be anywhere from 1-16 to ½ inch different. So he made the holder shown with a stop, which eliminated all possibility of his getting them wrong. *A* is a gray-iron stand, bored out at the top to fit bushings for different sized plungers. *B* is a bushing made a sliding fit in *A*. *C* is a headless adjusting screw. It can be seen that around the screw *C* there is plenty of room for any dirt that might get in, to drop away. *E* is a locking screw with a brass tip. The stand is set on the arbor press, and the plunger is forced down thru the collar *X*, thru bushing *B*, until it stops at the top of *C*. The collars are held by pins afterward. It is best if the various bushings are hardened. PEDRO RE.

Obtaining the Pitch of a Propeller.

The pitch of a propeller is the distance a point, moving along the helical path of the screw, would advance in the direction of the axis of the screw in one turn. If the pitch of a screw or propeller is 12 feet, it would advance 12 feet for every turn, providing there were no slip. If we suppose the propeller to be working in a solid nut, it would advance a distance equal to the pitch; but this is not the case when working in water, as the water yields and is forced back, hence the slip, which is the difference between the theoretical distance the propeller should advance and the actual distance it advances in making one turn. The slip varies from 1 to 12 per cent., according to the design of the propeller.

To obtain the pitch of a propeller blade from a casting or pattern, the method illustrated in Figs. 1 and 2 may be employed to advantage. Since a screw propeller blade contains but a small portion of the line generated by a point moving in the helical path of the blade for one complete turn, the pitch must be calculated by finding the distance a point at a fixed distance from the axis advances for that part of a helix which can be represented on the blade. And from this, calculating the distance the point would advance if the helical surface were continued for a complete turn, or determine it by a graphical method. Fig. 1 represents an adjustable wooden angle similar to an ordinary divider and about 4 feet 6 inches to 5 feet over all. It is provided with a wing for controlling the angle, and a thumb-screw or nut *B* for securing the side *D* to the wing. The edges of the pieces composing the sides *D* and *G* should be parallel, so that the angle *A* will represent the same number of degrees, whether measured under or outside. In obtaining the angle, a parallel straight-edge *C* is laid across the hub of the propeller. The bar *G* of the angle is then brought in contact with the face of the blade at a point well out, as shown. The bar *D* is then adjusted until it is parallel with the straight-edge *C* when the screw



OBTAINING THE PITCH OF A PROPELLER.

B is tightened. The angle *A* then represents the angle of the helix or blade for the radius *E*. Next develop the circumference of the radius *E* to any convenient scale, preferably the scale of one inch equals one foot. Lay off the circumference as shown in Fig. 2, and at one end erect a perpendicular *F*. Place the angle device with the inner edge of the bar *G* on the base line, and the point of the angle at *I*, draw a line along the inner edge of bar *D*, intersecting the perpendicular *F*. The distance *H* will be the pitch of the propeller to the same scale that was used in laying off the circumference of radius *E*. In finding the pitch of the blade of a sectional propeller, the straight-edges can be placed on the center line of the flange, which is usually placed on these flanges to assist in setting them in their sockets.

T. M.

Planing Half-Nuts.

This being a day off, I write with the double object of sending you a description of what I think is a very good jig for the purpose and making good the lost day's pay. At the shop we had to get out

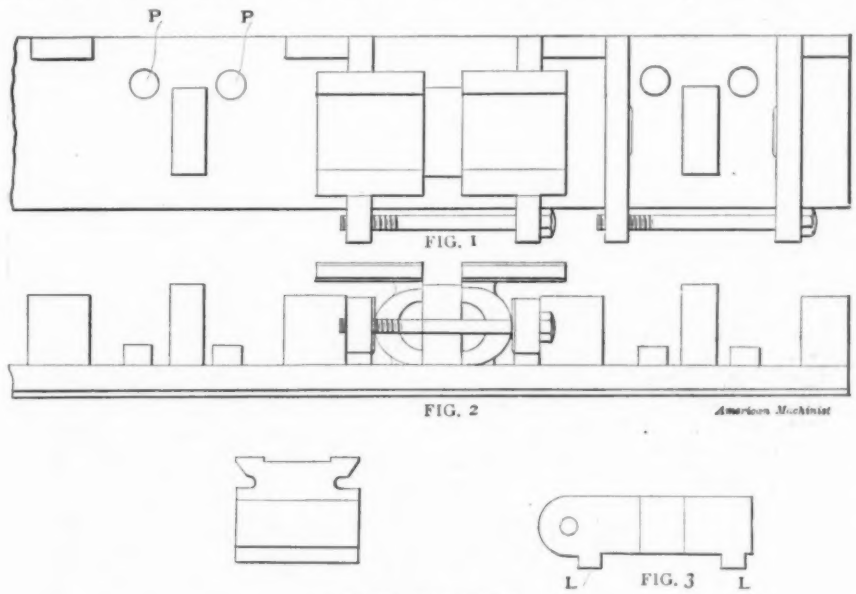


FIG. 1

FIG. 2

FIG. 3

PLANING HALF-NUTS.

a great many half nuts for the lead screw in the apron. Before the jig was made these were done on the shaper in pairs and numbered, the apron being milled out to fit a pair and also numbered. This was, of course, a very unsatisfactory and slow way. If any mistake were made in drilling or in the final fitting, the aprons would have to go to the shaper and have a new pair fitted. There were always several ready for that purpose. The jig and a gage with a taper wedge were made, and the half-nuts brought to a standard, and then no more numbering was done until the job came to the bench. The jig held six pairs of half-nuts; the castings were shaped off on the one side; they then had a good surface bearing against the jig, and were finished on a small planer. Fig. 1 is a top view of the jig, showing a pair of half-nuts in place; it also shows a pair of clamps for holding the nuts, the one screw clamping the two pieces. There is a raised spot on the center of the clamps to insure an even pressure on the face of the jig; the other ends of the clamps are backed against the lugs, as shown; the castings are located sideways by the pins *P P*. Fig. 2 is a side view. Fig. 3, the clamp; one of these is tapped for a 5-inch screw. The lugs *L L* hold it up properly without rock. The device worked very nicely, and there was no more trouble about getting out half-nuts fast enough or good enough.

CAMERON.

An Effort to Help Strawboss.

I do not think there are many men who would expect to start in as machinists without having spent any time learning the trade and do as well as those who had spent a lifetime at it. If circumstances were such that he should be given an opportunity to do machinists' work I think the average man who would have self-reliance enough to undertake such a thing would also know that it was necessary for him to keep continually on the alert to improve himself in the art all that he could. Many a man who is advanced to the job of being boss seems to fancy that there is nothing for him to learn that a mechanic does not already know.

The wail of the one who at page 390 signs himself Strawboss shows a condition of affairs that could be improved upon not only for him but I think, also, for the people he is working for and the men who are under his charge.

A machinist knows that there is hard iron, and sand holes, and poor tool steel, and rickety machine tools, and files that that are sprung, and hammers that are not hung right, and a whole lot of other things that he has to contend with and make allowance for in getting out his work. These are some of the things every man learns before he can be called a machinist.

Very few men work under perfect conditions in the average machine shop, and the measure of a man's capacity as a workman is the degree of success with which he meets all of these varying and imperfect conditions, and brings good work out of them.

When a man has learned enough of his trade to be entitled to class himself as a machinist he has also learned that there are certain conditions that he must meet to be able to get out the work. He may have to do work under some very unfavorable conditions, but a lathe hand would not try to work for a firm that hired him and then refused to furnish him with a lathe. I do not think many of them would stay very long if the Mr. Highboss of the establishment came around and worked the shipper on or off whenever the whim struck him, or if Mr. Super got into the habit of giving the cross carriage handle a turn one way or the other whenever he happened to be passing, or if Mr. Man got into the habit of throwing the feeds in or out just to help things along and let the lathe hand know that he took an interest in things. I think I have seen some rather dumb men running lathes, but I also think I know what would happen if anyone tried any such tricks on a machine that the dumbest of them was running and being held responsible for the work produced. Even a handy man knows that there are certain conditions that must be met to make the work come out right.

Right here I think is where Strawboss' trouble comes in. He is a handy man at the bossing trade, and not a journeyman, and he seems to be so unfortunately situated that he does not even know that bossing is at least a trade. I would be tempted to call it a profession, but that would bring up the idea of a college education. If it is not a distinct trade by itself it at least is an advanced branch of the trade, and just as the machinist has to know a lot of things that the helper in the shop need not bother his head about if he expects to stay a helper, just so the boss has to know a lot of things that do not come in the line of the machinist's work.

There are a whole lot of bosses who seem to think that all there is in being boss is to have the right to say who shall do the different jobs, and to growl at their men without danger of their growling back. To make up for this they have to take the growls from the office, and they get better pay.

The boss works under one difficulty. He generally has to learn the trade of bossing without an instructor. He is apt to get it hammered into him a little by disagreeable experience. If a man does not know

what there is to learn he is not apt to be very alert in learning it.

Mr. Highboss and the other interferences are only to the boss what hard iron and other unfavorable conditions are to the machinist. If there is a brother machinist in all the land who has nothing of the kind to keep his attention off the clock, I wish he would hold his hand up high enough to let the rest of us see where he is located. Some of us might have use for that kind of a place ourselves. Why should a boss expect to float along to pay day on flowery beds of ease? Let him buckle down and read up on the points where he is lame and learn the rest of his trade, and then he will know how to handle Mr. Highboss to the best advantage. If a water 'neal didn't do the business, he might try some other combination of methods to soften him up to the working point. He shouldn't get discouraged if his first effort is a failure. Just think of that piece of steel that stood all sorts of treatment and still was hard. You mind you didn't "jack" your job on account of it. When you found it too hard to turn, you did the last of the work by grinding. There are ways even in getting along with a meddlesome Mr. Highboss or Mr. Super.

Many a machinist does not get along in a new shop, because he does not study the conditions in the shop. He may have learned his trade in a shop where the very finest finish was insisted on as of the first importance, but that will not justify him in trying to put the same kind of finish on work in another shop where the ruling idea is a large quantity of rough work, and to fall behind in the amount of his output on account of it. He may think it a great mistake to do any work roughly, but that does not justify him in not doing it the way his employer wants it done.

If a man is continually trying to do the work differently from what is wanted, he should not be surprised if he is constantly interfered with. He should first show that he can do as much and as good work, of the kind wanted, as the other men, before he sets himself up as an improver or a critic. I have seen many a workman become extremely unpopular because he criticised the shop he came to work in, because it did not do work in the same way that some other one did. Even in a shop where things can be greatly improved to the advantage of all concerned, it is not wise to be in too big a hurry about it, or to be too radical in bringing it about.

I can sympathize with Strawboss if he finds his treatment is such that he is losing the respect of his men. That is a position that cannot be long tolerated with safety. When I say respect, I mean the kind of respect that leads a man to know that he must obey the orders of his foreman or get out. On this point there should not be any shadow of doubt. To the workman his foreman should be first, and any orders that reach him except thru the regular channels should be referred to his foreman for his sanction before being carried out.

The "uppers" in the establishment where these "strawbosses" are employed are said to be nice people, and it is likely that they are capable, or they would not be there, as I judge they are, at least some of them, merely working for a salary the same as the strawbosses. This being the case, they must be interested in results. Let them see that the bosses are really interested in the way orders have

FIG. I. EXHAUST ARRANGEMENT FOR BUFFING WHEELS, ANGUS SHOPS OF THE C. P. R. R., MONTREAL.

been given, and that they think better results could be gotten if they were given differently. Many a man in a shop is not pushed ahead, just because the boss never suspected that he was fit to be, and how can you blame the boss for not knowing if the man hides his head under a bushel?

I don't know Strawboss, at least not the one who wrote the article, but I think human nature is the same the world over, and if the real object is to help Mr. Highboss and the establishment that he represents, and care is taken to make that plain, time and patience should bring things right.

One of the easiest things in the world to do is to find fault, and one does not have to look far to find at least one reason for it. There are many ways of doing everything, and weak points in every combination that almost any of us could make different, *if*. The "ifs" in the other fellow's work do not impress themselves on us like those in our own work, and so we criticise, and often unjustly.

Strawboss seems to want advice which he may or may not think well of after he has received it. If I had a job as a machinist, and after I had given it a fair trial found that I could not do the work to suit the man I was working for, or if I found that I did not care to try to fit myself to the conditions in his shop, I should throw up the job. I do not see why a foreman should act any differently with a bossing job.

I would not hesitate to explain to a shop owner who was not a machinist that certain things were necessary in order that I give him a fair return for my pay. I have had more than one man working for me do the same thing to me with work that he knew more about than I did. Sometimes I wished it had been done a little more refined like, but even in the rough it was welcome. I have had men who were in charge of one helper only complain because of undue interference with that helper, and I have felt sympathy with them, too.

There is one thing I would say for the comfort of Strawboss. If he tries his best and tries to enter into the other fellow's side of it—that is to say, the fellows on each side (or every side) of him—he will get to have a fellow feeling that will at least make him more considerate of the feelings of those under his charge. Some day, by a turn of fortune's wheel, he may be a Mr. Highboss somewhere, and then he will avoid the mistakes that are now preventing him from enjoying to the full the nice things of this present job. W. OSBORNE.

Prominent liners entering New York consume coal daily as follows: "St. Paul," 350 tons; "Oceanic," 480 tons; "Lucania," 475 tons; "Deutschland," 570 tons; "Kaiser Wilhelm der Grosse," 500 tons; "Kaiser Wilhelm II," 600 tons, and larger ones are coming.

The International Railway Master Boiler Makers' Association will hold their fourth annual convention at Hotel Brezel, Buffalo, N. Y., May 16, 17 and 18, 1905.

Exhausting Arrangement for Buffing Wheels.

The half-tone shows a portion of the interior of the brass department of the Angus shops of the Canadian Pacific Railway at Montreal, Canada, and it is given here to direct attention to the effective means adopted for removing the dust from the wheels. The hoods will be noticed enclosing the wheels sufficiently, in connection with the suction maintained, to draw all the dust inward and downward. The hood is so designed that the heavy material drops into the front extension, whence it may be easily removed, while the air with the very light particles goes into the exhaust system. The hood in the foreground shows how it is hinged and hooked together, so that when it is unhooked the sides and the top may be swung away from the wheel.

The exhausting equipment consists of a 60-inch Sturtevant top horizontal steel plate exhauster, designed to run at 720 turns per minute and to discharge into a No. 18 cyclone collector. The fan or exhauster is supported on the roof trusses overhead, while the horizontal connections to the hood pipes are beneath the floor. The connecting pipes from the lines under the floor up to the fan are seen in the background. Fig. 2 shows in plan and elevation the arrangement of fan and pipes in detail. This entire arrangement was installed by C. H. Gifford & Co., managers of the Philadelphia house of B. F. Sturtevant Company, Boston, Mass.

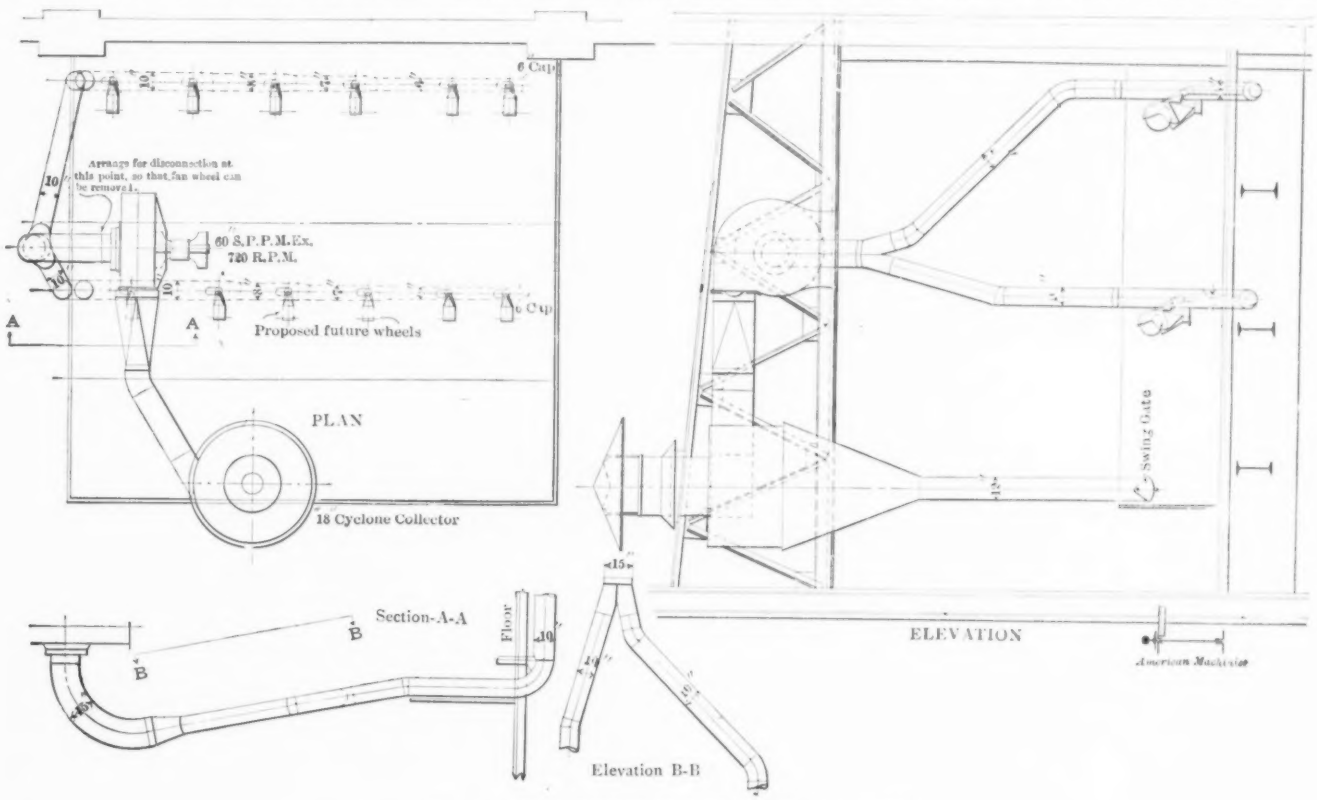


FIG. 2. ARRANGEMENT OF EXHAUSTER AND PIPES.

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The Automatic Versus the Hand Turret Lathe.

In last week's issue we published an article by P. V. Vernon, of Coventry, England, on the "Automatic versus the Hand Turret Lathe," which should be of interest to every reader who would keep himself posted on up-to-date manufacturing methods. As most of our readers are aware, the author is connected with the well-known English tool-building firm of Alfred Herbert, Ltd., a number of whose tools, particularly those in the automatic turret lathe line, have been illustrated in these columns, and he presents a method of handling in their magazine automatics, a class of work which an American contributor, writing at page 108, has been unable to handle satisfactorily on similar machines.

Not only is the article valuable as giving in detail the tool equipment and the sequence of operations by which an interesting piece of work is accurately and economically produced, but it is also of interest as showing in connection with the article which called it forth, that not all the conservatism in machine-shop matters is confined to England, nor all the progressiveness in tool designs and methods to America—a fact which has long been conceded by those who have spent enough time in manufacturing establishments on both sides of the Atlantic to appreciate something of the true conditions.

We have long been accustomed to hearing and reading about new fangled machinery being installed in foreign shops and hampered more or less by workmen who preferred to continue working under the old methods of manufacture; especially did we hear much of this at the time the bicycle craze caused the shipment of so many automatic screw machines and other tools to European countries. Also, much has been said in the past as to the poor grade of material which many English and Continental shops expected to handle satisfactorily in machines which from the very fact that they were automatic made it essential that true, homogeneous stock be used if anything like the maximum output was to be reached or an accurate product turned out. We cannot recall, however, that the tables have heretofore been reversed; that the suggestion has before been made from abroad that here in America and in a section where the automatic was originated and developed and where it certainly might be considered as in the "hands of its friends," there yet may be a tendency in certain shops to look adversely upon its introduction thru lack of sympathy with new methods generally, and in one way or another to prevent the benefits expected by its adoption from being realized.

Magazine automatics have been used long enough to demonstrate their fitness for a place in the up-to-date manufacturing plant; of this there can be no question. And with satisfactory castings and the proper tool equipment work may be turned out expeditiously and quite as accurately as if made from bar stock or on hand machines. The fact that Mr. Wesley has had unsatisfactory experiences with automatics of the magazine type may indicate that his machines were not tooled up in the best possible manner, that they had to contend with very uneven castings or with other adverse conditions. His experience, as Mr. Vernon suggests, does not prove that all other automatics would have failed or that the same machines with a different arrangement of tools would not have been successful; and it is possible that had he had just a little more faith in the utility of these improved machines he would have found some way to overcome the difficulties he encountered with them.

While it is conceivable that the builders of the machines, who refused to listen to any suggestions regarding them, may not have done a particularly conscientious job but were satisfied with a "good enough" one without realizing that that had got to be very good indeed in order to produce these high-speed parts within the necessary limits of accuracy, it will, we believe, be the general opinion among those whose work has kept them closely in touch with the development of this class of machines, that the cause of their unsatisfactory operation has been some condition beyond the control of the builder—such perhaps as might be brought about by irregularity in the size of the castings or by hard material. The writer during his connection with screw machine operations in the past has had under his immediate observation a good many instances where automatics when first installed were far from satisfactory, and in the majority of such cases the trouble has been directly attributable either to incompetent operatives or to the inferior character of the material, rather than to poor judgment or workmanship upon the part of the builders; in some instances, however, certain modifications which seemed necessary in a tool or two were made before the best results were obtained.

In this connection, there is called to mind the case of a number of magazine machines for handling work of much the same nature as that described by our correspondent. Strictly speaking, the character of the product did not call for the refinements necessary in swift-running spindles or whirls, but a notional manager had decided, nevertheless, that the work must be held in limit gages permitting but very little leeway one way or the other. The machine builders were provided with a lot of castings to experiment upon, and when the automatics (first and second operation) were installed, they ran satisfactorily until a fresh lot of castings came along. Then there was trouble—and plenty of it, all owing to the amount of variation in the size of the castings.

A lot would run off nicely, then a small

one would twist in the first-operation chuck, and be machined badly out of truth, or perhaps it would twist entirely out of the chuck and smash a tool. The foundry refused to reform, so the shop had to. A boy was set to gaging castings, and made about three lots of them. After the largest ones were run off, the chuck was adjusted slightly to hold the next size properly, and in this way further difficulty of the kind was avoided. It was thought best, however, to add a safeguard to the cross-slide in the form of a guide and positive support for the outer end of the roughing turner to hold it steady, regardless of irregularities in the castings; this proved quite a useful feature even after the castings began to come near enough to a size from the foundry to permit machining without preliminary gaging.

A peculiar feature of this job was that the work, which had a maximum diameter of about 1 inch, had an extremely short end for gripping in the first-operation chuck and this end had a slot cored directly across its face, thus cutting the hub into a pair of lugs, which could be gripped only about so hard without danger of breaking off. In the second-operation machine, this split hub was turned and threaded, and here it was eventually found advisable to make another slight modification in the tool equipment, as the dies furnished showed a tendency occasionally to jump into the openings in the surface they were threading, either spoiling the thread or injuring the die. By changing the number of the cutting edges and altering their form slightly, this tendency was overcome, and the anti-magazine feeling which had started to develop in certain quarters disappeared.

As in Mr. Wesley's case, there was a good oportunity to compare automatic- and hand-machine work in this particular department and there was never any question but what the magazine machines produced much better work day in and day out than the hand operators succeeded in turning out. This was due partly to the operators, who were none of the best by any means, and still more to the fact that the machine builders, instead of trying to adapt to the automatics the methods of machining followed for years on these particular hand turret lathes, went ahead on their own lines and on the experience they had been gaining in fitting up the same class of machines for somewhat similar work.

It may be of interest to note that certain features in connection with the tool equipment of the automatics were shortly after incorporated to advantage in the hand machines, which still had to be kept running on the same work, owing to the demands made upon the department for this class of material. This does not indicate, however, that the hand machines could not have produced just as good work from the beginning; what it does show is that it is possible in certain instances for a manufacturer to turn out a slightly inferior product under antiquated methods without realizing that he is doing this until a really up-to-date equipment is installed and he has an opportunity to compare it with his earlier appliances.

As to the relative merits of automatic and hand machines as such, this remains merely a question of the particular operation to be performed, the quantity of work handled in one lot, etc. Sometimes the hand machine is the better adapted to the case under consideration, sometimes the automatic. Both have large and growing fields to occupy (tho there is no sharply defined boundary line between) and both will doubtless be steadily improved—each along its own line—the better to handle the ever-increasing variety of work coming naturally within their province.

Cost of Machine Work by Area.

It may be recalled that the method of estimating and of paying for work which has been long used in certain shops in Manchester, and which was described at some length by John Richards in articles contributed to our columns several years ago, is based entirely upon area of tooled surfaces: these being divided into classes and estimated at different costs depending upon the degree of finish and of accuracy required, and also, probably, in some cases at least, upon the amount of stock to be removed. Mr. Stafford's article elsewhere in this issue on that subject, entitled "Reducing Time on Work by Accurate Time Study," shows that virtually the same system which has worked well for so long in some British shops, can be made to work well in an American shop also, and we believe this method of getting at the cost of machine work is well worth the attention of machine constructors whether from the estimator's or from the cost department's standpoint.

Laws Limiting Hours of Labor Invalid.

By an almost equally divided bench, the United States Supreme Court has decided that a New York State law limiting average working time in bakeries to ten hours per day and sixty per week is unconstitutional. The fundamental importance of the principle enunciated may be inferred from the statement quoted from Justice Harlan (who with Justices White, Day and Holmes, dissented from the majority opinion) that no more important decision has been rendered in the last century. The following extract from the prevailing opinion, delivered by Justice Peckham, seems to contain the gist of the matter:

"The general right to make a contract in relation to his business is part of the liberty of the individual, protected by the Fourteenth Amendment to the Federal Constitution. Under that provision no State can deprive any person of life, liberty or property without due process of law. The right to purchase or sell labor is part of the liberty protected by this amendment, unless there are circumstances which exclude the right."

Apparently this closes the door on paternalism as applied to the general body of citizens in the pursuance of ordinary occupations under employment by private parties. To give a State the power to prescribe hours of labor, circumstances must be exceptional. For instance, the employees must occupy such a position of helplessness as to be considered more or less under the guardianship of the State, or the work on which they are engaged must be so unhealthful as to furnish reasonable grounds for its regulation by the State under the police power. The police power is an extraordinary prerogative resident in government, by means of which it stretches some constitutional limitations when the public safety, health, morals or welfare so demand. The right so to do was tacitly, if not expressly, respected in framing the Constitution. There is a leading decision of the Federal Supreme Court in a case emanating from Utah, in which the power to restrict hours of labor in mines and smelters was upheld (Justices Peckham and Brewer dissenting). It is evident that such occupations are regarded as unhealthful, hazardous or arduous enough to furnish valid ground for exercise of the police power. On the other hand, this new decision establishes a rule that bakery work involves no such vicissitudes sufficiently pronounced for State intervention. Evidently the line of distinction must lie somewhere between these two. On the side of the line where freedom of contract is inviolable must be found the great majority of occupations. Attempts, therefore, to impose legal restrictions on the hours of ordinary labor for private persons seem henceforth to be futile.

It is not to be denied that some ground for exercise of the police power may be found in the case of bakeries. It may be argued, not without reason, that overworked employees become careless of the sanitary conditions of their output. One of the points on which the Supreme Court disagreed was, whether that tribunal might weigh the sufficiency of such arguments or must presume those questions to have been lawfully determined within the discretion of the legislature, provided unwarranted action by the latter was not clearly shown. Thus Justice Harlan, who was in the minority, said:

"I do not stop to consider whether any particular view of this economic question presents the sounder theory. The question is one about which there is room for debate and for an honest difference of opinion. No one can doubt that there are many reasons, based upon the experience of mankind, in support of the theory

that, all things considered, more than ten hours' steady work each day, from week to week, in a bakery or confectionery establishment, may endanger the health, impair the usefulness and shorten the lives of the workmen.

"If such reasons exist that ought to be the end of this case, for the State is not amenable to the judiciary in respect of its legislative enactments, unless such enactments are plainly, palpably, beyond all questions, inconsistent with the Constitution of the United States. We are not to presume that the State of New York has acted in bad faith. Nor can we assume that its legislature acted without due deliberation, or that it did not determine this question upon the fullest attainable information, and for the common good. We cannot say that the State has acted without reason or that its action is a mere sham. Our duty, then, is to sustain the statute as not being in conflict with the Federal Constitution, for the reason—and such is an all sufficient reason—it is not shown to be plainly and palpably inconsistent with that instrument. Let the State alone in the management of its purely domestic affairs, so long as it does not appear beyond all question that it has violated the Federal Constitution. This view necessarily results from the principle that the health and safety of the people of a State are primarily for the State to guard and protect, and are not matters ordinarily of concern to the National Government."

Following are some important extracts from the opinion of Justice Peckham, who was of the majority:

"The employee may desire to earn the extra money which would arise from his working more than the prescribed time, but this statute forbids the employer from permitting the employee to earn it. . . . The question whether this act is valid as a labor law pure and simple may be dismissed in a few words. There is no reasonable ground for interfering with the liberty of persons or the right of free contract by determining the hours of labor in the occupation of a baker. Bakers are in no sense wards of the State. Viewed in the light of a purely labor law, with no reference whatever to the question of health, we think that a law like the one before us involves neither the safety, the morals nor the welfare of the public, and that the interest of the public is not in the slightest degree affected by such an act. It is a question of which of two powers or rights shall prevail—the power of the State to legislate or the right of the individual to liberty of person and freedom of contract. The mere assertion that the subject relates to the public health does not necessarily render the enactment valid. The act must have a more direct relation as a means to an end, and the end itself must be appropriate and legitimate, before an act can be held to be valid which interferes with the general right of an individual to be free in his person and in his power to contract in relation to his own labor. We think the limit of the police power has been reached and passed in this case. . . . It seems to us that the real object and purpose was simply to regulate the hours of labor between the master and his employees, all being men *sui juris*, in a private business, not dangerous in any degree to the health of the employees."

The present decision is conclusive only as affects the powers of the States, but it is likely that the same principle can be made applicable to Congressional legislation. It is the States, indeed, whose relations with the citizens are the more intimate and whose limitations in matters of this character are the more consequential.

Obviously no curtailment has been made in the right of the State to impose what restrictions it pleases upon the hours of its own employees. There are, moreover, important classes of border-line cases where the question whether they shall be treated in this regard as public or private labor is a doubtful one. Such are cases of work done by municipalities and by contractors with them—which may be differently decided. The AMERICAN MACHINIST has on several occasions within the last few years commented on leading decisions that have been rendered, where such questions have been adjudicated. It would seem not altogether impossible that employees of *quasi* public corporations, such as transportation companies, might be subject to a closer legislative regulation of their labor dealings than purely private persons or corporations.

The opinion in the New York Court of Appeals which has just been reversed by the United States Supreme Court was written by Judge Parker.

The Test Indicator Used as a Comparator.

At page 428 we published an account of a comparator or indicator to be attached to a lathe, and to continuously indicate the diameter of work, instead of depending upon the calipers. We referred to this as coming from England, and thereupon received a letter from a former shopmate of the writer of the article, in which he says:

"I read with much interest the letter of my old friend and shopmate, H. E. Brown, descriptive of his comparator (page 428), also your editorial remarks pertaining to same—page 432. The latter are somewhat misleading in that those not acquainted with the circumstances would infer that the comparator was an English invention. Such is not the case.

"The comparator was invented by Mr. Brown some eighteen years ago, when he was serving in the capacity of foreman in the Boyer Machine Works, St. Louis, Mo., where I believe he served his apprenticeship.

"It was my fortune to be associated with him as a member of the Boyer working force at the time the comparator was introduced, and to the best of my knowledge it has been in constant use there ever since.

"I recall with great pleasure, and point to the fact with a pardonable degree of pride, that I was once an employee of that excellent shop and received the benefit of Mr. Brown's advice and direction in things mechanical."

The Steamship "Dakota."

A reception of the representatives of the press was held on board the Great Northern Steamship Company's magnificent steamer "Dakota," April 18.

The "Dakota" is practically the same as her sister ship, the "Minnesota," now trading on the Pacific Ocean, and was built and engined by the same concern, the Eastern Shipbuilding Company, of New London, Conn.

The "Dakota" is 630 feet long; 72½ feet beam; 88 feet 4 inches from the upper navigating bridge to the bottom of the keel. She has accommodations for about 3,000 passengers of all classes.

The ship is driven by twin screws and triple-expansion engines of about 10,000 horse-power. The boiler pressure is 250 pounds, supplied by sixteen Niclausse boilers built by the Stirling Boiler Company, Barberton, Ohio.

C. E. Walsh, of the Duluth Automatic Stokers, explained their working. They consist of a coal hopper at the front of the boilers and a traveling grate which carries the fire—of any desired thickness and at any desired speed—and dumps the ashes into a receptacle at the back end. From here the ashes are removed and forced thru a connection in the ship's bottom.

During the trial from Winter Quarters Shoal to Cape Charles Light, a distance of 59 nautical miles, the performance of the ship was as follows: Time consumed, 3 hours 20 minutes; average speed, 17.7 knots per hour. Revolutions per minute, 87. Indicated horse-power, 10,874. Pressure at boilers, 245 pounds; at high pressure steam chest, 215 pounds. Coal consumed per indicated horse-power per hour, 1¾ pounds. Quality of coal, Pocahontas. Thickness of fire, 6 inches. Speed of grates, 7½ inches per minute. Draft of ship forward, 17 feet 1 inch; draft aft, 21 feet 9 inches. Mean draft, 19 feet 5 inches. Diameter of propeller, 20 feet; pitch, 22 feet. During the trial the engines worked well and no trouble was experienced.

The "Dakota" has a well-equipped machine shop on board, containing a 24-inch by 12-foot Flather lathe, with taper attachment; a 30-inch back-geared drill press; a 24-inch Hendey shaper; a sensitive drill; an emery tool grinder; a grindstone; a

power hacksaw and a forge. The machine shop is run by motor; the bulk of the auxiliary on board is also electrical.

Decimalization of British Weights and Measures.

United States Consul Boyle, of Liverpool, England, reports that at a recently held annual meeting in London of the Association of Chambers of Commerce of the United Kingdom, a representative of the Liverpool Chamber moved a resolution (which was agreed to) as follows:

"That as another step in the direction of the adoption by this country of a decimal system of weights, and in supplement to the 50 pounds weight recently authorized by the board of trade to facilitate the weighing of cotton, corn, tobacco, etc., by centals and pounds, this association respectfully asks the board of trade to authorize forthwith weights of 20 pounds, 10 pounds and 5 pounds, also, as aliquot parts of the cental. In making this request the traders specially concerned wish to acknowledge gratefully the concession already made them in the matter of the 50 pounds weight, which has fully answered the expectations in the saving of time, labor and expense."

This we understand is in line with an effort being made to decimalize the British weights and measures, and also their coinage, considerable sentiment having been aroused in favor of such decimalization. Indeed it is thought by some who oppose the metric system that the only hope of resisting the increasing sentiment in favor of its adoption in Great Britain is by the decimalization of the present weights and measures; tho there are those who point out that such decimalization, especially in measures, would involve practically as much difficulty as would the adoption of the metric system, and yet it would not place Great Britain in line with the Continental nations which use the metric system. The report of Consul-General Boyle goes on to give quite an extended and interesting history of how some of the queer weights and measures now generally used in Great Britain originated.

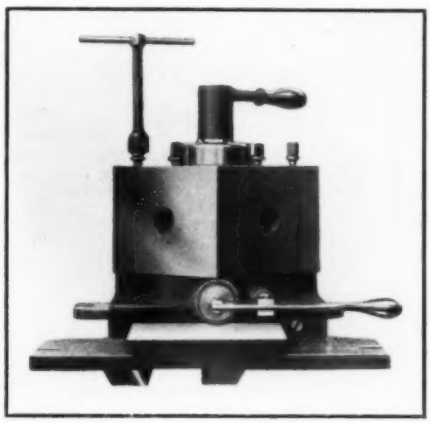
As an encouragement to long and faithful service in one establishment, the Belgian government grants industrial decorations, the conditions being a service of not less than twenty-five years and a recommendation by an employer for faithfulness. Only one candidate for every one hundred workmen employed can be selected yearly if the period of service is twenty-five years. If thirty years, one candidate for every twenty-five workmen may be selected.

For brass molds, a very soft iron should be used. Common machinery iron does not answer at all well, as it soon develops cracks on the surface of the mold casting. The best iron for this purpose is that which cuts very easily.—*Brass World.*

New Tools and Machine Shop Appliances.

NEW TURRET FOR LATHE CARRIAGE.

The half-tone illustrates a lathe carriage turret designed to have stiffness and rigidity commensurate with the increase in cutting power of tool steel and still be interchangeable with the regular compound rest. As will be seen from the illustration, the principal departure from the ordinary standard is in the plate on which the cross-slide moves. This is made to slide on to the regular carriage dovetail and be held in place by four bolts in the T-slot of the carriage wings. The cross-slide is made with a bearing about twice as wide as the regular compound rest. The plate is slotted, permitting the cross-feed nut to extend up and attach to the cross-slide, so that the cross-feed can be applied to the turret. As no movement of the plate takes place, the regular carriage dovetail is relieved of all wear. The makers are the Lodge & Shipley Machine Tool Company, Cincinnati, Ohio.



NEW TURRET FOR LATHE CARRIAGE.

A 24-INCH LATHE WITH MOTOR DRIVE.

The illustration shows a 24"x8' lathe with motor drive thru all geared head, equipped with special multiple tool rest used in rapid turning of cone pulleys.

The motor is 9 horse-power, of the direct-current, variable-speed type (600 to 1,200 revolutions per minute), started, stopped and reversed by the controller handle placed at the right-hand end of the carriage. The speeds obtained electrically supplement the speed changes obtained mechanically thru the all-geared head.

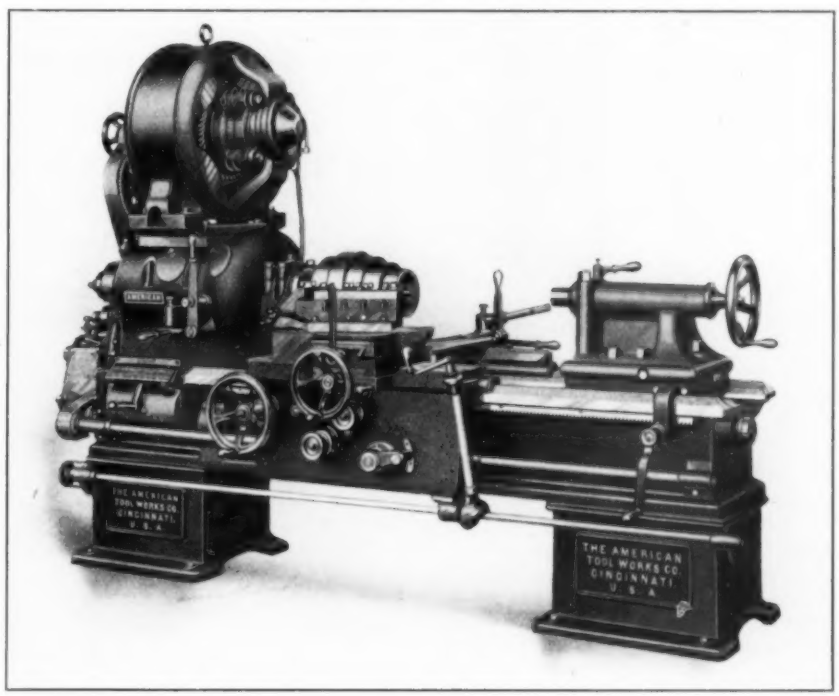
The all-geared lathe head provides four spindle speeds, the ratios of which are 32.5 to 1, 10.8 to 1, 4.31 to 1, and 1.44 to 1.

Each mechanical speed is obtained while the machine is in operation thru the manipulation of the two levers shown on the front of the head. Only six gears are required in this device.

The necessary adjustment for any desired speed can be determined readily by reference to an index plate on the front of the head.

This lathe is also equipped with rapid-change gear mechanism, providing a wide range of changes for feeding and screw cutting, each change obtainable while the machine is in operation. The index plate shows how to obtain any desired feed.

This lathe, tho motor driven, may be arranged for belt drive by simply replacing the gear on the driving shaft with whatever size pulley is desired. The reg-



A 24-INCH LATHE WITH MOTOR DRIVE.

ular carriage equipment consists of compound rest and full-swing rest.

The lathe is designed to withstand the high speeds and feeds possible with high-speed tool steels.

It is built by the American Tool Works Company, Cincinnati, Ohio.

AN INSTANTANEOUS MONKEY-WRENCH.

The wrench shown in the half-tone is instantaneous in adjustment, in that the jaw is at once slid in either direction to the position desired, and a half turn of the handle locks it securely. The long sleeve with the helical groove turns freely on the stem and a lug on the sliding jaw fitting into this groove turns the sleeve when the jaw is moved, and it is then only necessary to lock the sleeve. The lower

INSTANTANEOUS MONKEY-WRENCH.

end of the sleeve is enlarged in diameter and its outer face has fine radial teeth. Corresponding teeth are cut in the upper face of the sliding collar below it. The handle encloses the entire sleeve, its lower end being tapped to fit the thread on the end of the stem. Then, when the handle is in its place, a half turn of it carries the locking collar into engagement with the teeth of the sleeve, and upon turning the handle in the other direction the collar is forced back by a spring. The handle, it will be seen, covers and protects everything. All parts of the wrench are steel. The jaws are drop-forged and the gripping faces are perfectly parallel. The wrench is made by the Richards Tool Company, 15 Court Square, Boston, Mass.

TUBULAR MICROMETER FRAMES AND A BENCH SHEAR.

Fig. 1 shows a new type of micrometer frame combining lightness and rigidity, the frame being made of a single piece of sheet metal formed into a tube of rectan-

FIG. 1. TUBULAR MICROMETER FRAME.

gular cross-section with ends tapering and bent into a semicircular shape. On the tapering ends are suitably fastened two sleeves fitted with locking devices for positively fastening in place any standard make of detached micrometer head on the one side and the adjustable anvil on the other. Four frames comprise the set for measuring from 0 to 12 inches. As many mechanics and shops now commonly have detached micrometer heads for use in various tools, a set of such frames will enable them to have at hand a micrometer of suitable size for the work in hand.

The bench shear in Fig. 2 is an accurately built tool designed for die- and general toolmakers' use. Its construction is

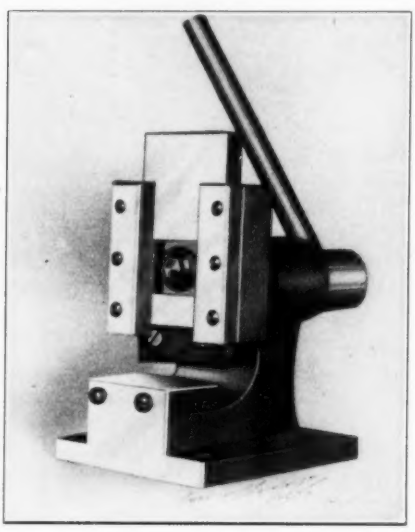
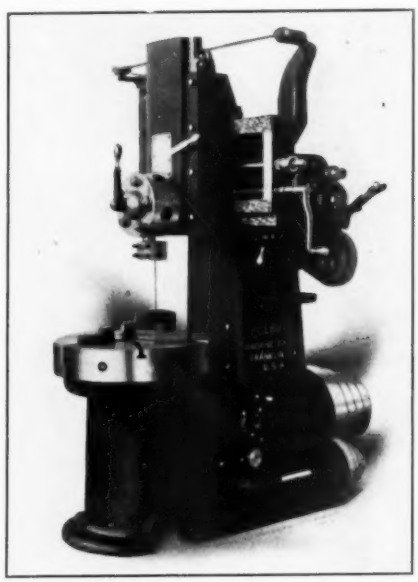


FIG. 2. BENCH SHEAR.

shown from the engraving. It will cut 5-32 inch common sheet tool steel and softer stock 3-16 inch thick; the throat is deep enough to permit stock 4 inches wide to be split along the center. A. J. Machek, 401 Nineteenth street, Milwaukee, Wis., is the maker of these tools.

30-INCH VERTICAL BORING MILL.

This boring and turning mill has a swing of 30 inches, and will take in work 18 inches high. It has sixteen changes of speed in exact geometrical progression, varying from 3.2 to 106.2 turns per minute. The mill is made with plain table with or without chuck jaws, or with three- or four-jaw combination independent and universal chuck. The main driving gear is bolted to the lower part of the chuck or table, and is driven by a spur pinion. The table spindle has a large phosphor bronze conical bearing at the top, and the spindle extends downward nearly to the floor and has two large vertical bearings to resist side strains. A system of lubrication supplies oil to all these bearings. The back gearing is powerful, and the gears are thrown in and out without stopping the machine by means of the handle shown at the side of the column. There are eight feeds driven by means of a belt running



30-INCH VERTICAL BORING MILL.

on cone pulleys of large diameter. The feeds are reversed by means of the hand lever shown directly above the upper feed-cone pulley. The vertical slide has a travel of 23 inches, either by hand or power. A graduated scale 24 inches long is attached to the turret slide, and an adjustable pointer moves over the scale, indicating at all times the travel of the turret slide. The cross slide has a travel of 17½ inches, either by hand or power, and is equipped with an automatic stop for tripping the feed before the head comes to the center stop. The turret is 10¼ inches in diameter, and has five holes bored to fit tool shanks 2¼ inches in diameter. The turret has a clamp lever which remains in a vertical position when released. The lock bolt is of hardened tool steel, ground true, and works in a hardened tool steel index ring also accurately ground. A double friction countershaft is furnished, having two pulleys

14 and 20 inches in diameter for 4-inch belt. Both pulleys run in the same direction, one at 150 and the other at 375 revolutions per minute. The weight of this mill is 4,500 pounds, and it occupies a floor space of 4 feet 7 inches by 5 feet 4 inches. It is built by the Colburn Machine Tool Company, Franklin, Pa.

Personal.

The students of the Hebrew Technical Institute, New York, were addressed on April 24 by Fred J. Miller on "The Chances for a Machinist."

A. E. Martin, who has been superintendent of the works of the Barr Pumping Engine Company, has taken a position with the Dean Steam Pump Company, of Holyoke, Mass.

H. La Casse, formerly vice-president and manager of the Auburn Ball Bearing Company, Rochester, N. Y., has severed his connection with it, and has joined the Standard Manufacturing Company of the same city, as mechanical expert.

O. H. Reynolds, who has been the New York editor of the *Railway and Engineering Review*, is now editor of the *Railway Master Mechanic*, with offices in the Vanderbilt Buliding, Nassau street, New York.

R. E. Spencer Geare, M. E., formerly consulting engineer to Colgate & Co., has severed his connection with that company, and will be identified with Walter S. Timmis, consulting engineer, 150 Nassau street, New York city.

L. D. Bolton, heretofore Chicago representative of the Federal Manufacturing Company, is now with the Diamond Chain & Manufacturing Company, of Indianapolis, and will represent that company in the Middle and Western States.

Obituary.

James C. Todd, an old-time machinist and inventor, died at Paterson, N. J., April 17, eighty-five years old. He was a native of New Jersey and went to Paterson when nine years old. At the age of twenty he was working on the first locomotive built by the Rogers Locomotive Works. Later he was inventing and developing hemp and flax spinning machinery, forming the partnership of Todd, Mackay & Co. and carrying on the machine business for many years.

Henry Howard died in Philadelphia April 18, eighty years old. Mr. Howard was born in Manchester, England, and was brought to this country when a lad. After serving his apprenticeship as a machinist with Eastwick & Harrison he went to Russia with the firm, building locomotives for the government. Returning to this country, he started in business for himself in Philadelphia in 1850. Ten years later he entered the employ of the Pennsylvania Railroad, where he remained until he was retired in 1900.

Business Items.

Thru a change in the personnel, the firm of Krausse & Schneck, Milwaukee, Wis., has been merged into the new firm of Chas. W. Schneck, Bro. & Co. The facilities of the concern will be largely increased.

The executive offices of the American Steel Foundries, until recently located at 74 Broadway, New York, have been removed to 42 Broadway, where all the departments of this concern will be located in the future.

The C. H. Wheeler Condenser & Pump Company has succeeded the Barr Pump Company, of Philadelphia. The company's principal office is in Philadelphia—Lehigh avenue and Eighteenth street—with a branch at 26 Cortlandt street, New York. Sales offices will soon be established in Chicago and elsewhere. The specialties of the new company are condensers, jet or barometric; vacuum and circulating pumps, electric, geared or steam driven; water-cooling towers; pumping engines and all auxiliaries for complete plants for both stationary and marine service, including highest vacuum guarantees for turbine requirements. The officers of the company are John Pitcairn, president; Geo. Burnham, Jr., vice-president; C. H. Wheeler, secretary; Otto W. Schaum, works manager, and W. H. Rometsch, treasurer.

Manufacturers.

The Duluth (Minn.) Tar Company will erect a new plant.

The National Tube Company, Lorain, O., will enlarge its plant.

Cannon & Flanagan are erecting a harness factory at Winder, Ga.

The Easley (S. C.) Cotton Mills is building an extension to its plant.

The Ames Iron Works, Oswego, N. Y., will erect an addition to its plant.

The plant of the Bullock Electric Company, at Norwood, O., is to be enlarged.

The Towanda (Pa.) Silk Mill Company, a new corporation, is erecting a mill.

The Worcester (Mass.) Pressed Steel Company is erecting a new rolling mill.

The Siver Carriage Company, Oneida, N. Y., will put up an addition to its factory.

The Ashtabula (O.) Construction Company has been formed and will erect a plant.

The Richardson Scale Company, New York, will erect a new factory in Passaic, N. J.

The Union Jack Company, of Plainfield, Ind., has incorporated and will erect a factory.

It is reported that W. A. Boole & Son, Oakland, Cal., shipbuilders, will enlarge their plant.

The American Writing Paper Company, Holyoke, Mass., will make additions to its plant.

The Wilmington (Del.) Sash, Door & Blind Company is having plans prepared for a new factory.

The Pelican Stone Company, Pelican Rapids, Minn., has been organized and will erect a plant.

The plant of the West Ware (Mass.) Paper Company was destroyed by fire; loss, $75,000.

The Florida Power Company has been incorporated, with a capital of $300,000, at Ocala, Fla.

A new cement plant will be built at Cedartown, Ga. G. W. Whitefield, of that place, is interested.

The Fort Payne (Ala.) Stove & Foundry Company will rebuild its plant, which burned some time ago.

The American Tube & Stamping Company, Bridgeport, Conn., is erecting an addition to its billet mills.

The Northwestern Lithographing Company, Milwaukee, Wis., will put up a new $20,000 factory.

The Chicago Brass Company, Kenosha, Wis., has decided to spend $1,000,000 in improving its plant.

Fire in the drying room of Beebee & Son's leather tannery at Titusville, Pa., caused a damage of $175,000.

The Louis Drach Construction Company, Cincinnati, O., will build a plant to manufacture concrete block.

The Berlin Machine Works, Beloit, Wis., is having a new building erected, to be used as a pattern department.

The Milwaukee (Wis.) Gaslight Company will erect a new plant, which is to be one of the largest in the country.

The Longmont (Colo.) Farmers' Mill & Elevator Company will erect a mill in Denver, to cost about $100,000.

The Hooven & Mason Contracting Company, Chicago, Ill., will erect an ore dust reducing plant at Hubbard, O.

The Norfolk (Va.) Construction Company, recently organized, will erect a plant for making concrete building blocks.

The Camden (N. Y.) Water Wheel Works is erecting a new machine shop, to be equipped with the latest machinery.

It is reported that the Fay & Scott Machine Company, Dexter, Me., contemplates building an extension to its factory.

The Toledo, Port Clinton & Lakeside Railroad Company has let the contract for the erection of a power-house at Port Clinton, O.

The plant of the Kewanee (Ill.) Mining & Manufacturing Company, which was destroyed by fire some time ago, is to be rebuilt.

Geo. G. Prentice & Co., machinery manufacturers, will shortly occupy their new works on Fair Haven Heights, New Haven, Conn.

Hayes Bros., Janesville, Wis., contractors, are figuring on a $300,000 power-house, to utilize the water power of the Chicago drainage canal.

Alden Sampson will build a $50,000 automobile factory at Pittsfield, Mass., which will include a water-wheel equipment and electric generators.

Styles & Cash, New York, will erect a new plant, which will be used exclusively for their own business of printing, manufacturing stationery, etc.

The saw and planing mill, known as the Munson Mill, at Williamsport, Pa., and owned by Geo. B. Breon, was destroyed by fire; loss, $50,000.

The Stratton Rotating Engine Company, of Buffalo, recently incorporated with a capital of $500,000, will, it is reported, erect a factory in North Tonawanda, N. Y.

The Easthampton (Mass.) Gas Company will discard its present electric plant and install a new one. A 23,000-volt alternating-current generator will be put in.

The Southern Box & Lumber Company, capitalized at $25,000, will erect a plant in New Albany, Miss. J. T. Beker, J. S. Wells, of that place, and others are interested.

The Innes-Demarest Stove & Heating Company, Binghamton, N. Y., capitalized at $200,000, will put up several buildings, one of which is to be used as an engine-house.

It is announced that orders have been issued for the construction of a universal plate mill as part of the Gautier department of the Cambria Steel Company, at Johnstown, Pa.

The Union Drawn Steel Company, of Beaver Falls, Pa., informs us that the item published at page 541, to the effect that it is about to erect a branch mill at Hamilton, Ont., under the name of the Canadian Drawn Steel Company, is an error, as the mill which it will erect there will be chartered under the name of the Union Drawn Steel Company, Limited. The company has no connection with the Canadian Drawn Steel Company.

The city of Central Falls, R. I., is contemplating the erection of a municipal lighting plant, and wishes to receive estimates of the probable cost of such a plant. It has a population of about 20,000 in an area of about a square mile, an a total valuation of about $9,000,000. A copy of the plan of the city, drawn to scale, and giving the location of lights, poles, etc., will be mailed on application to the clerk of the Committee on the Municipal Lighting Plant, Wm. H. Goldsmith, Central Falls, R. I.

New Catalogs.

The Butler Chuck Company, Greenfield, Mass. Circular describing and illustrating the Graves self-adjusting loose pulley oiler.

National-Acme Manufacturing Company, Cleveland, O. Revised price lists of milled, set and cap screws, adopted April 1, 1905.

The Hess-Bright Manufacturing Company, 245-7 North Broad street, Philadelphia, Pa. Catalog of ball bearings containing illustrations and various tables. 6x9, pp. 26, paper.

Bullard Automatic Wrench Company, Post Office Box 158, Providence, R. I. Catalog describing a new pipe wrench made by this company. Contains illustrations and price list. 3½x6, pp. 11, paper.

We have received from the Westinghouse Companies' Publishing Department, Pittsburg, Pa., advance copy of a publication entitled "Church Lighting by Electricity," which they are preparing for the Nernst Lamp Company. Illustrated. 6½x7, pp. 12, paper.

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Punches & dies. Wal.M.Wks., Waltham, Mass.

Turret lathe work, light machinery, tools, models, etc. Metal Novelty Co., Elgin, Ill.

Will buy or pay royalty for good patented machine or tool. Box 282, AMER. MACHINIST.

Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N. J.

Machinist Table—Standard steam, gas and water pipe tapping sizes; 5c., stamps. E. E. Meyer, Allegheny, Pa.

Wood patterns of every description; high-grade gas engine work a specialty. Trenton Pattern Works, Trenton, N. J.

Would like to build some standard specialty on orders; low prices; prompt delivery. W. S. Machine Company, care AMER. MACH.

Dies, jigs and fixtures; tools designed for special work; manufacturer of clockwork specialties and intricate mechanical instruments. D. S. Plumb, 57 E. Park st., Newark, N. J.

Medium size modern plant wants contracts; close work on automatic and interchangeable machinery; will buy good tool or machine, or manufacture on royalty. Box 521, AM. M.

W. H. Chappell, the best shop organizer and manager in America and inventor of the red light system, solicits correspondence regarding engagements. Box 57, AM. MACH.

Wanted—Manufacturers to use premium system; shop cost reduced; output increased; no trouble with employees; system successfully installed; results guaranteed. Box 525, AMERICAN MACHINIST.

Modern foundry and machine shop, fully equipped for light and medium heavy work, wishes to manufacture engines, machines or machine parts; would undertake sale if desired; castings made in malleable, gray, brass, bronze and aluminum. Trenton Malleable Iron Co., Trenton, N. J., and 26 Cortlandt st., New York.

Wanted—In vicinity of New York, up-to-date boiler works and machine shop, fully equipped to take up the manufacture of steel plate tanks and apparatus for patented condensation water purifying process; parties willing to take an interest preferred; full investigation solicited; state facilities for turning out large orders in first-class manner. Box 8, AMERICAN MACHINIST.

Tool Machinery.—Wanted, as soon as possible, by a large German factory of tool machinery a specialist for a steady, well-paying position, in the manufacture of boring-bit chests, holding devices, special machines and apparatus for a rational manufacture of lathes and other tool machinery on a large scale. Practical engineers who have held similar position in North America for a longer period of years and who are well versed in calculation, are preferred. Write Box 2, care AMERICAN MACHINIST.

For Sale.

For Sale—Machine shop in southern Michigan; good, live, paying business. Address Box 494, AMERICAN MACHINIST.

For Sale—Wheeler planer, 7 ft. platen, planes 27 in. wide and 24 in. high; vise, centers, angle irons, parallels, tools; a fine, heavy tool, in good order; all f. o. b. Brockton, Mass., for $250. Wm. A. Sweetser, 20 Keith ave., Campello, Mass.

I can sell your machine shop (or other business), with or without real estate, no matter where it is or what it is worth. Send description, state price and learn how. W. M. Ostrander, 111 North American Bldg., Philadelphia.

For Sale—Aluminum and brass foundry; fine jobbing trade; light and heavy castings; long established and in good paying condition; price reasonable; good reason for selling. Apply Adam Weaber, 320 Landis ave., Vineland, N. J.

Business Opportunities.

We want a few thousand dollars to enlarge our business, and desire to interest a party who will take an active interest either as salesman, machinist or patternmaker. Address P. O. Box 216, Lewiston, Idaho.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be enclosed to unknown correspondents. Only bona fide situation want or help want advertisements inserted under this heading. Agency advertisements must be placed under Miscellaneous Wants.

Situations Wanted.

Classification indicates present address of advertiser, nothing else.

CONNECTICUT.

Foundry superintendent, young and strictly temperate, desires larger field; automobile and gas engine cylinder expert; French and German methods and mixtures employed; can furnish best of references. Box 41, A. M.

Situation Wanted.—A first-class mechanic, 7 years as superintendent of a large plant, past 2 years master mechanic; experienced on large and small tools, press work and dies, plating, steam, electric, wood-working and automatic machinery; capable of handling successfully most any class of manufacturing; can not only direct, but can do; a close student, and a large, well-developed experience. Box 38, AMERICAN MACHINIST.

MASSACHUSETTS.

Mechanical draftsman wishes position. Address Box 28, AMERICAN MACHINIST.

Wanted—A position as engineer; experienced in running and erecting. Box 40, A. M.

Gray iron foundry superintendent wishes to change; engines, machinery; practical in all departments; up to date; good references. Address Box 47, AMERICAN MACHINIST.

Situation wanted with machinery building concern in Eastern States as assistant superintendent; practical shop experience from machinist to head draftsman and designer; familiar with exact interchangeable work; posted on up-to-date manufacturing methods and systematic shop management; age 34. Address Box 62, AMERICAN MACHINIST.

MICHIGAN.

Designing draftsman, experienced on light, interchangeable machinery and in manufacture of same. Address T., care AM. MACH.

Mechanical engineer and expert with practical shop experience and up to date in manufacturing problems; open for engagement in May. Box 42, AMERICAN MACHINIST.

Manager—Thoroughly experienced in all kinds of light manufacturing, contemplates change; can reduce costs and show results; 15 years' experience. E. E. E., care AM. M.

NEW JERSEY.

Machine draftsman open for position. Box 36, AMERICAN MACHINIST.

Mechanical draftsman, experienced, desires position in or near Philadelphia; salary $12. Box 56, AMERICAN MACHINIST.

Foreman toolmaker, 15 years' experience in tools for drop forging and working sheet metal, is open for position. Box 33, AM. M.

Designing draftsman; technical, practical and successful on special machinery and tools; 4 years as shop foreman. Box 44, AMERICAN MACHINIST.

Traveling salesman position wanted by mechanical engineer; 29 years old; 4 years' shop experience; 4 years' experience in drafting, etc.; would consider low salary at start. Box 45, AMERICAN MACHINIST.

NEW YORK.

Mechanical draftsman, generally machinery, wishes position. Box 61, AMER. MACH.

Experienced mechanical draftsman wants position. Box 54, AMERICAN MACHINIST.

Mechanical draftsman, age 24, for detailing out and tracing, desires position. Box 55, AMERICAN MACHINIST.

Thorough mechanic, age 29, inventive and executive ability, foreman 8 years, desires change. Steam or gas engines preferred. Box 64, AMERICAN MACHINIST.

Designer of leading American automobiles open for engagement; go anywhere; best references; age 30; expert shop organizer and cost reducer. Box 60, AMER. MACH.

Toolmaker—First-class on fine, accurate work, jigs, fixtures, dies, model and experimental work, jewelers' tools, metal patterns, automatic machinery. Address O. K., A. M.

Toolmaker, 15 years' experience, tool, jig and fixture, experimental model and die making, familiar with gun and typewriter work, desires change; recommendations. Box 43, AMERICAN MACHINIST.

Young man, 23, with 5 years' experience in machine shop and 1 year in drafting room, wishes position with chance of advancement, in New York city, Connecticut or New Jersey. Address Box 52, AMERICAN MACHINIST.

Mechanical engineer, extended experience; designing, superintending, managing, improving processes; engine and machinery manufacturing and installation lines; steam and electric power and lighting plants; open for engagement. Box 50, AMER. MACHINIST.

Mechanical engineer, 12 years' experience, desires change; up to date on tools and fixtures, cost reduction and shop management; successful in the design and construction of hoisting and conveying machinery; experienced estimator and correspondent. Box 16, AMERICAN MACHINIST.

Civil engineer (German), with extensive experience in general machine construction and office management at European mercantile and government shipyards, seeks similar position in this country, with either public or private industrial concern. Address Box 39, AMERICAN MACHINIST.

PENNSYLVANIA.

Draftsman, 6 years' experience, good on detailing, desires position. Box 53, AM. M.

Mechanical draftsman, German, college graduate, 2 years' shop experience, 2½ years' office experience special tool machines and hydraulic presses, wants position; will go anywhere. Box 1, AMERICAN MACHINIST.

Help Wanted.

Classification indicates present address of advertiser, nothing else.

CANADA.

Wanted—A mechanical superintendent for one of the largest and best equipped machine tool, press and general machinery plants in Canada; one who will take a reasonable financial interest in the business; must have thorough knowledge of costs, handling men, master details, produce results and be capable of producing accurate interchangeable work advantageously; state age, experience, last positions filled, references and salary wanted. Box 511, AMERICAN MACHINIST.

ILLINOIS.

Machinists Wanted—High-class floor and vise hands; highest wages; state experience and pay expected; city of 25,000. Address Box 48, AMERICAN MACHINIST.

Patternmakers.—A large manufacturing company has vacancies for several patternmakers; must be familiar with engine work and general heavy machinery patterns. Address, with full particulars, "Patterns," Box 34, AMERICAN MACHINIST.

Wanted—A first-class machine foreman to take charge of 35 or 40 machine hands operating lathes, planers, milling machines and gear cutters; a man only who can get out high-grade work at low cost and handle men need apply. Box 37, AMER. MACHINIST.

Wanted—Engineer, competent to supervise the construction of large steel buildings adapted for manufacturing purposes, and who has had experience upon similar work; also an experienced building inspector and architectural and structural draftsmen familiar with machine shop construction and design; applicants should give in detail their experience, qualifications and references, enclosing copies of letters of reference, and state age, salary expected and how soon they will report for duty if engaged. Address "Buildings," P. O. Box 1065, Chicago, Ill.

INDIANA.

Wanted—Machinist; a first-class man as fitter on screw machines. Box 392, AM. M.

Wanted—A competent, experienced man to take charge of assembling departments in automobile factory; must be able to run on strictly up-to-date manufacturing methods; state experience, references and salary wanted. Address Box 25, AMERICAN MACHINIST.

MASSACHUSETTS.

Wanted—Inspector and assistant superintendent for large gear cutting shop. Address "Gears," care AMERICAN MACHINIST.

Wanted—Machinist for general gear cutting work; one accustomed to Fellows gear shapers preferred; also want one man for cutting spirals. Address "Gears," care AM. M.

Wanted—Young technical graduates, both electrical and mechanical engineers, for testing steam turbines and electric generators. Apply to Testing Department, General Electric Company, West Lynn, Mass.

Wanted—A first-class draftsman on small automatic machinery, tools, etc., and designing; up-to-date factory in Worcester County; state age, experience and wages expected. Address Box 46, AMERICAN MACHINIST.

MICHIGAN.

Wanted—Salesmen or agents to sell a patented specialty of great merit for boilers, which is already being used by the largest concerns. Address Power Specialty Co., 513 Washington Arcade, Detroit, Mich.

NEW JERSEY.

Wanted—An experienced foundry cost-clerk; state salary, references, etc. Box 35, AMERICAN MACHINIST.

Wanted—First-class machinery painter, experienced on engine work. Address Box 51, AMERICAN MACHINIST.

Screw Machine—Wanted, first-class operators on Brown & Sharpe automatic. Box 63, AMERICAN MACHINIST.

Lathe, planer and boring mill operators wanted for night shift; those accustomed to machine tool work preferred; steady work and good pay to good men. Address the Pond Machine Tool Co., Plainfield, N. J.

Foreman Wanted—By a live concern doing light structural iron work; must know how to handle help to the best advantage; man having some experience in designing jigs preferred; state experience, age, salary expected and reference. Address C. S. P., care A. M.

First-class boring-mill, lathe and planer hands should file applications with us, as the constant and rapid growth of our business is always calling for additions to our force; our plant is modern in every respect and is located in a suburb of New York, where there is plenty of room, air and sunlight. Remember, we pay first-class wages and want only competent men. Henry R. Worthington Hydraulic Works, Harrison, N. J.

NEW YORK.

Wanted—First-class draftsman; preferably familiar with pumps; give experience, etc. Box 24, AMERICAN MACHINIST.

Competent draftsmen for machine shop in South Brooklyn. Address, with full particulars, Box 58, AMERICAN MACHINIST.

Wanted—Draftsman who has had experience in machine designing; state experience, give reference, age and salary expected. Eddy Valve Company, Waterford, N. Y.

Wanted—Experienced machine shop storekeeper, also metal pattern maker familiar with molding machine patterns; state experience, references, etc. Box 65, AM. MACH.

Wanted—Several first-class draftsmen; give age, experience, reference and salary expected. Apply to Engineer in Charge, Drafting Department, General Electric Co., Schenectady, N. Y.

Several good draftsmen and tracers wanted on light construction work by large concern in New York city. Steady positions to good men; state age, experience and salary expected. Box 59, AMER. MACH.

Wanted—Draftsman well acquainted with steam engine and steam pump work; must be familiar with valve gear, etc.; only an experienced man desired. Address stating age, experience and salary. "Independent Works," AMERICAN MACHINIST.

Office manager for the clerical force of large corporation; able executive, competent and responsible; salary $1,500; other managerial, clerical and technical openings on file; free list and plan on request. Business Opportunity Co., 1 Union Square, New York.

Mechanical or electrical engineer wanted; a large manufacturing company near New York has good opening for bright young man familiar with construction work, modern shop methods, installation of machinery, piping, etc.; applicants should give experience, reference, age and salary desired. Box 23, AMERICAN MACHINIST.

Wanted—Experienced man to check drawings on light interchangeable work; must be capable of discovering errors in figures, unmechanical details and features involving undue difficulty or expense in machining or assembling; state age, education and salary expected and outline previous experience; location, central New York. Address Box 49, AMERICAN MACHINIST.

OHIO.

A New Departure.—The Cleveland Automatic Machine Company, of Cleveland, O., appreciating the extensive demand for competent operators, have established a free employment bureau and are soliciting the name and address of all competent non-employed operators, and in securing them they hope to not only very materially assist the operator, but also assist those who may employ them.

PENNSYLVANIA.

Machine and floor hands, familiar with machine tool work. Standard Engineering Works, Ellwood City, Pa.

Wanted—First-class draftsman on mill construction and equipment; technical man preferred. Box 4, AMERICAN MACHINIST.

Experienced mechanical draftsman wanted at once at steel works in Eastern Pennsylvania. "Mechanical," care AMER. MACH.

Wanted—First-class boring mill, floor and bench hands; steady work at good wages. The Stoever Foundry & Mfg. Co., Myerstown, Pa.

Wanted—Lathe, planer and boring mill operators for night shift; men accustomed to machine tool work preferred; steady work to good men. Address Colburn Machine Tool Company, Franklin, Pa.

Wanted—Experienced draftsmen in electrical apparatus, switchboard motors and generators; only first-class men need apply; state experience and salary expected. Box 29, AMERICAN MACHINIST.

TEXAS.

Wanted—Superintendent for our machine shop, working about 30 men now, but expect to enlarge shortly; our work is general repairs on sawmill, cotton oil mill and sugar machinery engines, locomotives, marine engines and pumps; we also build new rotary pumps and other machines on orders; have no special machine line that we manufacture; our general foundry is well equipped and under capable management; must be competent to make estimates on all work, a handler of men—in fact, a first-class man. Address, with full particulars as to former work, salary, etc., Dickson Car Wheel Co., Houston, Texas.

WISCONSIN.

Wanted—Several draftsmen and detail men for Corliss engine work. Apply to Brown Corliss Engine Co., Corliss, Wis.

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General Elec. Co., New York.
Sprague Elec. Co., New York.
Stanley Elec. Mfg. Co., Pittsfield, Mass.
Westinghouse Elec. & Mfg. Co., Pittsburg, Pa.

Boring and Drilling Machines, Horizontal

Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Beaman & Smith Co., Provi., R. I.
Betts Mach. Co., Wilmington, Del.
Binsse Mach. Co., Newark, N. J.
Boynton & Plummer, Worcester, Mass.
Dallett Co., Thos. H., Phila., Pa.
Detrick & Harvey Mach. Co., Baltimore, Md.
Draper Mach. Tool Co., Worcester, Mass.
Fosdick Mach. Tool Co., Cin., O.
Gisholt Mach. Co., Madison, Wis.

Boring and Drilling Machines, Horizontal—*Cont'd*

Hill, Clarke & Co., Boston, Mass.
Lucas Mach. Tool Co., Cleve., O.
McCabe, J. J., New York.
Motch & Merryweather Co., Cleveland, O.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles-Bement-Pond Co., New York.
Pawling & Harnischfeger, Milwaukee, Wis.
Prentiss Tool & Supply Co., New York.
Springfield Mch. Tool Co., Springfield, O.
Vandyck Churchill Co., New York.
Warner & Swasey Co., Cleveland, Ohio.

Boring and Turning Mills

American Tool Wks. Co., Cin., O.
Baush Mach. Tool Co., Springfield, Mass.
Bertram & Sons Co., Ltd., John, Dundas, Ont., Canada.
Betts Mach. Co., Wilmington, Del.
Bullard Mach. Tool Co., Bridgeport, Conn.
Colburn Mch. Tool Co., Franklin, Pa.
Gisholt Mach. Co., Madison, Wis.
Hill, Clarke & Co., Boston Mass.
King Mach. Tool Co., Cincin., O.
Niles-Bement-Pond Co., New York.
Poole Co., J. Morton, Wilmington, Del.
Prentiss Tool & Supply Co., New York.
Vandyck Churchill Co., New York.
Warner & Swasey Co., Cleveland, Ohio.

Brakes, Magnetic Friction

Electric Controller & Supply Co., Cleveland, O.

Cabinets, Tool

Armstrong Bros. Tool Co., Chicago, Ill.